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ORIGINAL ARTICLES

THE MECHANISM OF WIRE STRETCHING

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IN the November, 1917, issue of the JOURNAL there appeared an editorial entitled, "A Word of Caution in Regard to the Use of the Wire-stretching Pliers." I am so impressed with the possibilities of this instrument for good or for harm, that I wish to use the following diagrams in further explanation.

In the editorial attention was called to three facts; namely, that the beaks of the pliers must be of the proper shape, the material must possess the proper physical characteristics, and the pinch must be made with a knowledge of the various results to be obtained by a movement of the handle of the pliers. It was also stated that the beaks must be parallel at the finish of the pinch. Attention was also called to the fact that a wire-stretching pliers that has been designed or shaped to pinch one gauge of wire must not be used on another gauge; for example, if pliers the beaks of which are shaped to pinch a 19-gauge wire are used on an 18-gauge wire, it will be found that instead of the wire being lengthened in a straight line or without curvature, the ends of the wire will bend away from the pliers. If wire-stretching pliers designed to pinch 19-gauge wire are used on a 20-gauge wire, the ends of the wire will bend towards the handle of the pliers.

Fig. 1 shows the relation the beaks of the pliers must bear to each other at the close of the pinch. If the beaks are parallel cylinders (or cylinders of the same diameter which are parallel to each other) at the close of the pinch, the wire will be lengthened without any curvature. If the external portion of the beaks of the pliers close more nearly together than the internal portion, the ends of the wire will be turned toward the handle as shown in Fig. 2. In Fig. 2, *A* represents a piece of straight wire before the beginning of the pinch with pliers the beaks of which resemble the general outline shown in Fig. 2. At the completion of the pinch, the straight piece of wire shown at *A* will assume the position

represented by *B*. It can readily be seen what a large amount of harm would be done to a regulating appliance if a wire was pinched with this style of pliers without the operator realizing what was taking place.

If, on the other hand, pliers are used of which the external portion of the beak does not close as tightly as the internal portion, the wire would be turned away from the pliers as illustrated in Fig. 3.

A of Fig. 3 represents the straight piece of wire before the beginning of the pinch, while *B* shows the manner in which the wire would be curved if pinched by a pliers, the beaks of which had a general relation as shown in Fig. 3. It must be remembered that the relation of the beaks of the pliers as illustrated in Figs. 2 and 3 are exaggerated, and of course, can readily be detected by the eye. In actual practice, it must be remembered, that such a small variation as can not be detected by the eye, will produce changes in the wire as illustrated in Figs. 2 and 3. It therefore becomes necessary before using a wire-stretching pliers to take a straight piece of wire and pinch it outside of the mouth and carefully observe what results have taken place.

There is probably no force used in the correction of irregularities that has as many advantages as the force obtained from the wire-stretching pliers prop-

Fig. 1.

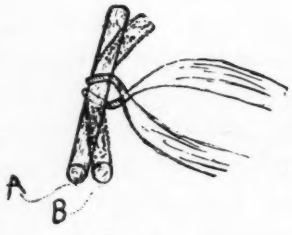

Fig. 2.

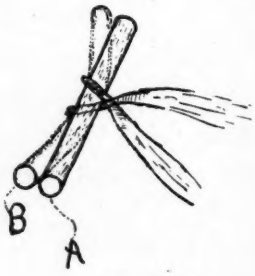

Fig. 3.

erly applied. It can equally be said that there is no force which is liable to do more harm than that obtained from the wire-stretching pliers, if their use is not understood or if the beaks of the pliers are improperly shaped, because of the fact the force is exerted so gradually that the tooth change occurs without the operator hardly realizing how these changes are occurring. We are aware of the fact that a great many men have begun using the wire-stretching pliers before they have become familiar with their mechanical action, and consequently have produced many undesirable tooth movements without being aware of how those movements occurred. I, therefore, would caution all to first be absolutely certain that the beaks of the wire-stretching pliers are so shaped as to produce a straight pinch, or rather a pinch which will lengthen the wire without bending it. Second, it must be remembered that the wire-stretching pliers adjusted to one gauge of wire can not be used on another gauge of wire. Third, it must be remembered that the wire used with the wire-stretching pliers must be one which is capable of giving an even pinch without the wire becoming brittle during the pinching.

It has been found that some of the alloys containing gold and platinum are unsuited for use with the wire-stretching pliers because these metals seem to crystallize during the pinch, which results in the wire breaking at the place where

the pinch is made. Other alloys are entirely too hard which have resulted in the breaking of the wire-stretching pliers as well as in producing a pinch that is brittle. At the present time the most satisfactory wire for use with the wire-stretching pliers is a 16 per cent iridioplatinum wire. It must also be remembered that in making a pinch on a lingual or labial arch with the wire-stretching pliers a certain tooth movement will be produced according to the place and manner in which the pinch is made.

In presenting the following diagrams, it must be remembered that they have been made to show the mechanics of the wire-stretching pliers, and the changes that occur as a result of the pinch and various manipulations of the pliers during the pinch. The force resulting from the use of the pliers is accurately shown in the diagrams, and can be proved by technical demonstration, provided both ends of the wire are held rigid during the pinch. In the use of the wire-stretching pliers on an appliance, it must be remembered that the resulting movements of the teeth will depend upon the anchorage and resistance offered by the supporting structures. Furthermore, I wish to state that all of these various movements and mechanical principles have been utilized by

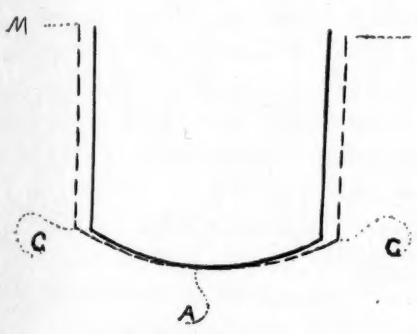

Fig. 4.

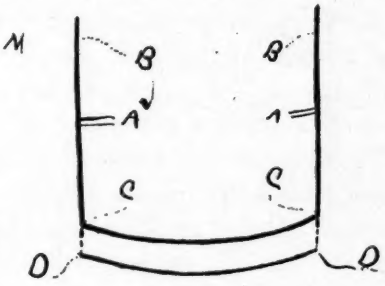

Fig. 5.

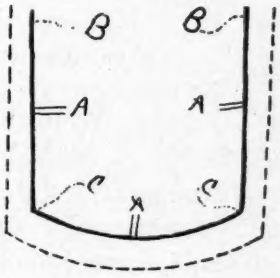

Fig. 6.

Lloyd S. Lourie and I have employed a great many. This statement is made at this time to impress upon the reader the practical application of the principles shown by the following diagrams.

The solid line drawing in Fig. 4 represents a lingual arch which is soldered to the molar band. If it is desired to produce a buccal expansion of the molar and premolar region, a pinch made in the lingual arch somewhere in the incisal portion about the region of *A* will produce a lengthening of the lingual arch from *C* to *C* which in turn will carry the lateral halves of the arch from *C* to *M* buccally. This pinch made in the incisal portion of the arch preferably near the central portion will lengthen the arch from *C* to *C* and produce the expansion as shown by the dash line in Fig. 4. If pinches are made in the canine portion of the wire, a pinch must be made on both the right and the left side to produce an equal expansion. If a pinch is made only on one side of the wire in the canine region, it will produce a change in the wire as shown in Fig. 10. In order to produce an equal expansion in both the canine and molar regions, the pinch in the incisal portion at *A* must be made with the beaks of the pliers held absolutely stationary, without a movement forward or backward or without any rotation of the handle of the pliers. It is never advisable to make more than two pinches at one sitting in the incisal portion of the arch. Care must be taken not to place

enough stress upon the wire between *C* and *C* as to produce a bend in the wire. It must remain absolutely the same except in length in order to produce an expansion in the molar region without rotating or tipping the molars. If a sufficient number of pinches are made at one sitting to strain the wire and produce a bend from *C* to *C*, the molars will be tipped or rotated in some manner.

In Fig. 4 it has been shown that if the wire-stretching pliers are placed in the incisal portion of the alignment wire between *C* and *C* and a pinch is made without moving the beaks the alignment wire will be widened in such a manner as illustrated by the dotted line.

If the alignment wire is pinched anywhere in the molar region between *B* and *C* as illustrated in Fig. 5 the premolar section of the alignment wire will be lengthened between *B* and *C* and the incisal section will be carried forward to the position represented by *D;* that is, the incisal section will be carried forward provided the molars are not moved distally. The purpose of Fig. 5 is to illustrate the possibility of lengthening the premolar section of the lateral halves of the dental arch by pinching the alignment wire in the premolar region and carrying the incisors forward without any expansion in the incisal portion.

If it is desired to expand in the molar and premolar region, and at the same time carry the incisal portion of the alignment wire forward, thereby expanding the dental arch in all regions, that tooth movement can be produced by making pinches in both the incisal and the premolar sections at points illustrated by *A* in Fig. 6. In order to produce this increase in size of the alignment wire and thereby expand the dental arch as illustrated by the dotted line in Fig. 6, the wire-stretching pliers placed at point *A* must be held stationary and not rotated or the handles moved during the time the pinch is being made. By making a pinch anywhere between *B* and *C* the lateral half of the alignment wire will be lengthened by making a similar pinch between *C* and *C* the dental arch will be expanded or the alignment wire will be lengthened in the incisal portion.

Realizing the fact that any change in shape of the lingual wire from *C* to *C* will produce a certain degree of movement in the molar region, we will find in certain cases it is desirable to move the molars or expand the molars more than the canines. As a result of this, it is therefore necessary that we be familiar with the peculiarities of the action of wire under the wire-stretching pliers in order to produce the movement desired in the molar region. In Fig. 7 the heavy black line represents the lingual arch soldered to the molar bands. In this particular case it is desired to produce more of an expansion in the molar region than in the canine region, and also to produce an equal expansion of the molars on the right and the left side. This can be accomplished by placing the wire-stretching pliers at a point on the lingual arch represented by 1*A* and while the pinch is being made, traction is made upon the wire-stretching pliers towards the molars so as to change the position of the pliers from 1*A* to 2*A*. As a result, the position of the lingual arch will be changed as shown by the dotted line from *C* to *C* resulting in a pressure being placed on the molars represented by the dash line from *B* to *C*. This will throw the right and left molar region buccally in the relation as shown by the dotted line which of course will move the distal portion of the molar more buccally than the mesial portion.

We now realize that in some instances it is desirable to have this type of ex-

pansion of the molars; but instead of having the distal end of the molar moved more buccally than the mesial end, it is desired to move the mesial end equally as far as the distal. This movement of the molar buccally in a straight line is then produced by making a second pinch in the lingual arch in the region of the molar as shown in Fig. 8. In Fig. 8 the heavy black line represents the lingual arch as shown by the dash line in Fig. 7. It will be noted that the distal end of the heavy left back arch is thrown out the same as the alignment wire is in Fig. 5. Therefore, if it is desired to move the molars buccally without any torsiversion of the distal corner, the wire-stretching pliers is placed on the arch at *A* in the position as shown by drawing *1*. As a pinch is made, the handles of the pliers are rotated distally from position *1* to position *2* as shown by the solid and dotted handles. As a result of this movement a bend at point *A* is made in the alignment wire from *A* to *B* which has no elasticity. From *A* to *C* the alignment wire is sprung, and because of this elastic spring from *A* to *C* the lingual wire returns to the original position represented by the black line with the result that the dead bend from *A* to *B* stays in the alignment wire, effect-

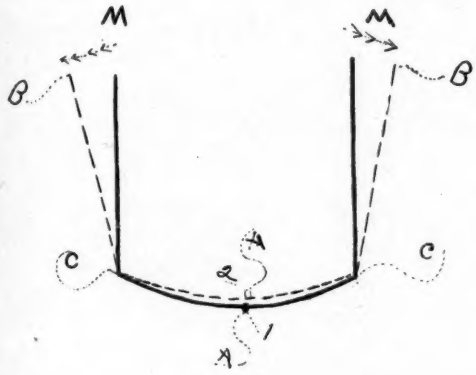

Fig. 7.

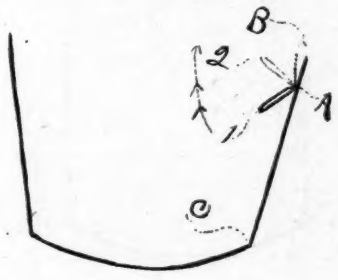

Fig. 8.

ing a change in the position from *A* to *B* as represented by the dotted line. Because of this dead bend in the alignment wire in the molar region the mesial corner of the molar will be rotated and made to occupy the position represented by the small dotted line.

By a careful study of Figs. 7 and 8 it will be seen what a change can be produced in the shape of the alignment wire by making the two pinches illustrated. The first pinch made in the incisal portion of the wire (Fig. 7) at point *A* and by moving the pliers distally at the same time the pinch is being made results in a change shown by the dash line in Fig. 7. After that pinch is made, the second pinch and bend shown in Fig. 8 made near the molar bend, results in the rotation of the molar. The various changes shown in the molars in these two diagrams must be carefully carried in mind and they also illustrate the necessity of being perfectly familiar with each pinch and bend that the wire-stretching pliers will produce upon the various teeth.

In Fig. 9 we have an illustration that shows the possibility of producing a lingual movement in the molars as a result of the wire-stretching pliers. Again, the heavy black line represents the shape of the alignment wire before any stress is brought to bear upon it by means of the wire-stretching pliers. In this illus-

tration, the wire-stretching pliers are placed in position shown by 1*A* which is an incisal portion of the arch somewhere between the canines *C* and as the pinch is made the pliers is forced forward with the result that the incisal section of the alignment wire is changed as represented by the dash line. The distal ends of the alignment wire, which are soldered to the molar bands, will be carried lingually, resulting in a narrowing of the molar region. There are very few cases in which a lingual movement of the molars is desired; but in those cases where it is desired, it is one of the most satisfactory means of accomplishing the change. The lingual movement of the molars has been accomplished in a great many cases when men have not desired that movement, because they unconsciously have produced stretching with the wire-stretching pliers which is illustrated in Fig. 9 in position 1*A* and 2*A* of the pliers.

It must be remembered that pinches made with the wire-stretching pliers at different positions will produce different changes in the shape of the alignment wire and therefore produce different tooth movements. It must also be remembered that a radical different change in the shape of the alignment wire will be produced when the pinch is made in a straight portion of the wire or when it

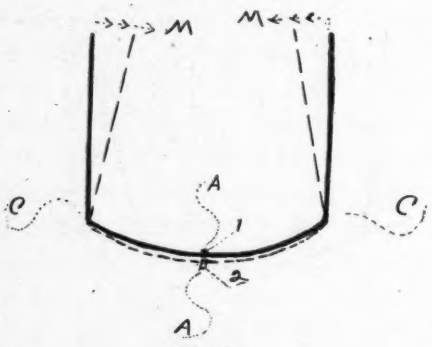

Fig. 9.

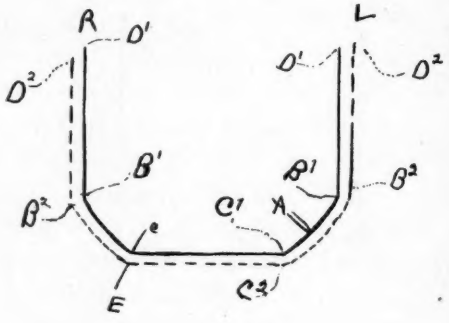

Fig. 10.

is made in a curved portion. A large majority of the lingual arches have a greater curve in the canine region as is illustrated in the curvature between *B1* and *C1* in Fig. 10. If the wire-stretching pliers represented by *A* pinch the wire in the curved section between *B1* and *C1*, it will result in a twofold movement which will be a carrying buccally of the premolar section to the dash line as shown between *B2* and *D2*. The portion of the alignment wire *C1* will be carried forward in the position shown at *C2*. This is the result of the lengthening produced by the pinch made at *A* in the curved portion of the alignment wire between *B* and *C*. It will be noticed that the incisal section of the alignment wire as represented by *C* and *E* have not been lengthened; neither has the premolar portion of the alignment wire represented by that portion between *B* and *D*. The only lengthening in the alignment wire has occurred in the curved section between *B* and *C* as a result of the pinch *A*.

Pinching the alignment wire between the points *B* and *C*, will exert a backward force upon the left molar that will tend to force it distally, as illustrated by the dash line as related to the solid line. A forward force will be exerted on the right molar which will tend to move it forward. This force can be utilized when it is desired to move one side of the arch forward and the other side back-

ward, always remembering that the movements will vary according to the resistance offered by the various teeth. This style of movement is utilized by Lourie.

Of course, several pinches can be made in that section of the alignment wire between *B* and *C* but each pinch, provided the wire-stretching pliers are held stationary and the pinch is made at right angles to the wire, will result in changes as shown by the dash line and the only lengthening will occur in that portion of the wire between *B* and *C*. If a pinch is made only in the curved portion of the alignment wire on one side as illustrated in Fig. 10, it will produce a change in the shape of the alignment wire as shown in the dash line. In other words, it will produce an expansion in the canine region of the dental arch on one side only resulting in what might be termed a warping of the dental arch which can be seen by studying Fig. 10. In a number of cases this style of tooth movement may be desired, but in other cases the operator may get this movement without knowing how he produces it and it may not be a desired movement. We therefore caution all who begin the use of the wire-stretching pliers to realize that the force produced is constant and every time a wire is pinched a particular and positive effect is produced according to the position in which the pinch is made, the manner in which the beaks are held or moved during that pinch, and the

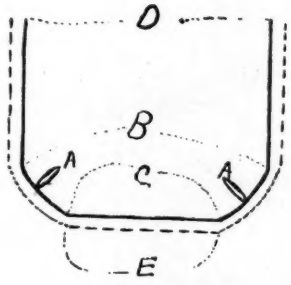

Fig. 11.

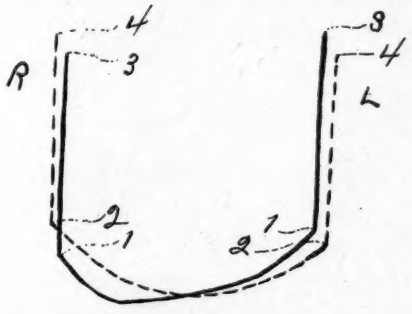

Fig. 12.

position in which the pliers are placed on the wire. Now this warping of the alignment wire as a result of the pinch in the curved section as shown in Fig. 10 may be desirable, in fact, it can be utilized to cause the alignment wire and dental arch to assume a shape which will result in moving the molar section forward on one side and distal on the other as before mentioned.

Fig. 11 shows the change in shape, which would occur if the alignment wire was pinched an equal amount in the canine region on the right and the left side. Pinches made in the wire between the points *B* and *C* would increase the length of the wire in that section and leave the length from *B* to *D* unchanged. Likewise the incisal portion of the wire *E* would be unchanged.

In Fig. 12 we have a diagram which requires a very careful study in order to realize the peculiar possibilities and movements which can be accomplished by the wire-stretching pliers used under certain conditions. Fig. 12 illustrates the possibilities of changing the shape of the lingual alignment wire by means of the wire-stretching pliers in such a manner as to move one lateral half of the arch forward and the other backward with no other force except the pinched wire. The heavy black diagram represents the shape of the alignment wire before any pinches are made. On the right side of the alignment wire marked *R* the

wire-stretching pliers are placed in the canine region at the point on the heavy line shown as *1*. As the pinch is made, the handle of the pliers is moved distally to the point shown at *2* which results in a change of the curvature of the alignment wire in that region represented by the dotted line. On the left hand side in the canine region, the pliers represented at *1* are placed on the wire and as the pinch is made the pliers are forced forward, causing a change in the curvature of the wire as again represented by the dotted line. This results in the canine portion of the lingual wire on the right side being so curved and shaped as to assume a distal spring, and the one on the left side is made to assume a mesial spring. As a result of this, the right premolar region of the alignment wire shifts distally from the position *3* to *4*. On the left side a mesial shifting occurs in the premolar region from the position *3* to *4*. It will be seen then by this diagram, as a result of the pinches as outlined, that the right half of the alignment wire has shifted backward and the left half has shifted forward. This movement is very desirable in certain cases and also may be produced accidentally if the operator is not familiar with the technic of the pliers.

In some cases we find it is desirable to place upon the canines bands to which a wire has been soldered. Very often with this style of appliance, it is desired to change the perpendicular relation of the canines, which can be very easily accomplished as shown in Fig. 13. The dark, heavy perpendicular line and the

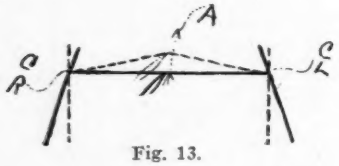

Fig. 13.

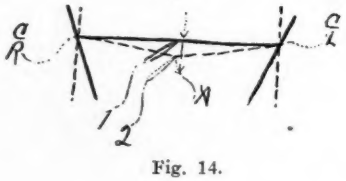

Fig. 14.

cross line represent the position of the canine and the position which the wire occupies before any pinch has been made in it. Now, if the wire-stretching pliers are placed at *A* in the position *1* and as the pinch is made the pliers are moved occlusally, it will result in a change in the wire which will produce a tipping of the apices towards each other and the moving of the crown buccally. A reverse movement of the canines can be accomplished as shown in Fig. 14 if the wire-stretching pliers *A* is placed at the first position *1* and as the pinch is made is moved gingivally to *2* which will change the wire in such a manner as to tip the crown lingually and the apices labially as shown by the dash line. Besides being possible to tip the canines in either direction as shown by Figs. 13 and 14 the expansion of the canine can also be accomplished by making straight pinches anywhere on the wire between the two canines.

In some cases where we have bands upon the canines to which a wire has been soldered, we find it is desirable to tip one canine mesially or distally or in some instances, one mesially and the other distally. This movement can be accomplished by putting a torsional spring in the wire as illustrated in Fig. 15. The heavy shaded lines, perpendicular and cross lines, represent the position of the canines which have been banded and connected by a labial wire. If it is desired to tip the right canine forward as represented by *B* and have a distal movement on the apex of the tooth, the wire-stretching pliers *A* are placed on

the wire in the position shown at *1*. As the pinch is made, the handles of the pliers are rotated occlusally, effecting a torsional bend in the wire represented by the arrow between *1* and *2*. Between the points *A* and *B* a dead bend is made in the wire owing to the short distance between the pinch and the soldered attachment. Between *A* and *C* a torsional spring is made which being a live spring causes that portion of the wire to return to its original shape, and the canine *B* is moved to the position represented by the dash line. There is an equal force exerted on the canine *C* which would have a tendency to tip that tooth in the position shown by the dash line.

In studying Fig. 15, it must be borne in mind that this movement occurs because of the fact that in rotating the pliers *A* from *1* to *2* a dead bend is made between *A* and *B*, while between *A* and *C* we have an active spring, or an active bend, which contains a spring force, that results in a portion of the wire from *A* to *C* returning to its original position; and in order for it to return to its original position, owing to the dead bend between *A* and *B*, the canine *B* must be rotated according to the position shown in the dash line.

If we should have a case of a canine in which it is desired to tip the crown distally and the apex mesially or forward, it can be accomplished by means of the

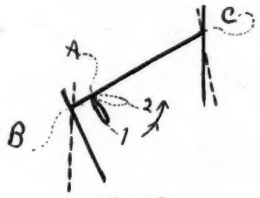

Fig. 15.

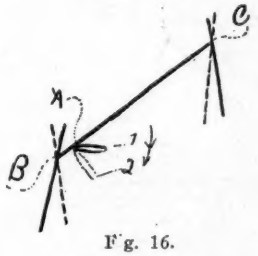

Fig. 16.

pinched wire and using the pliers as illustrated in Fig. 16. In this case the beaks of the pliers *A* are placed in the position shown at *1* and as the pinch is made, the handles of the pliers are rotated gingivally, which results in a dead bend between *A* and *B*, and an active torsional spring between *A* and *C*. As the active spring returns to its original shape and as the point between *A* and *B* is a dead bend, the canine *B* is made to assume the position shown by the dotted line. An opposite force is exerted on the other end of the appliance *C* which has a tendency to change the canine *C* in the opposite direction to *B*. In considering the possibilities of tooth movements as a result of the torsional spring, one can readily see what a large amount of harm can be done when an operator produces a torsional spring in the alignment wire unknowingly. In using a lingual alignment wire, which has the bands upon the molars, it must be remembered that tipping of the molars bucco-lingually can be very easily accomplished by making pinches in a certain position of the alignment wire and by producing certain movements of the wire-stretching pliers during this pinching.

In Fig. 17 the heavy black line represents a lingual alignment wire which has been soldered to molar bands and the original position of the molars are represented by the black perpendicular line. Now, if the wire-stretching pliers *A* are placed in the position shown at *1* and as the pinch is made, the pliers are moved gingivally but not rotated, the result will be a change in the shape of

the incisal section as represented by the dash line, which will produce a twist or a torsional spring in the premolar section represented by the arrow. As a result of this torsional spring in the premolar section, the occlusal portion of the molars will be tipped lingually and the apices will have a tendency to move buccally. In making this pinch and movement of the wire-stretching pliers as shown from *A1* to *A2*, the incisal section will assume a V-shape that is illustrated by the dash line. This bend in the incisal section will also have a tendency to narrow the lingual alignment wire in the canine region. In order to overcome this lingual narrowing in the canine region, if it is desirable to at the same time produce expansion of the canines, a series of small straight pinches must be made in the incisal portion of the arch to produce expansion which will overcome the narrowing of the lingual wire produced by the gingival bend from *1* to *2* at *A*.

Fig. 18 shows the possibility of tipping the occlusal surface of the molars buccally and the apices lingually by making the reverse movements as shown in Fig. 17. In this case, the wire-stretching pliers grasps the incisal portion of the lingual wire at *1* and as the pinch is made the wire is carried occlusally, which has a tendency to change the incisal section of the wire as represented by the

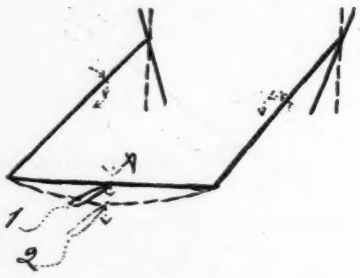

Fig. 17.

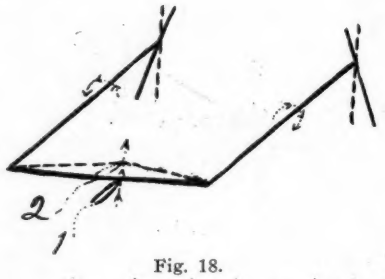

Fig. 18.

dash line and thereby produce torsion upon the premolar section as indicated by the arrows. This force moves the occlusal surface of the molars buccally and the apices lingually. While it is possible to rotate the molars by making a pinch and bend in the incisal region as shown in Fig. 18, it is preferable, if the rotation of the molars is desired, to produce that rotation by means of making a pinch in the premolar region, as shown in Fig. 19. Such change as produced in the alignment wire in Figs. 17 and 18 will produce a rotation or tipping of both molars, while such a pinch as made in Fig. 19 will produce a buccal or lingual movement of only one molar and produces this movement without the tendency of any change in the shape of the alignment wire in the incisal region. In Fig. 19 we again have the alignment wire represented by the heavy black line and the original position of the molars represented by the heavy black lines. The wire-stretching pliers is placed at point *A* in the first position represented by *1*, and as the pinch is made, the handle of the pliers is rotated occlusally to position *2* as shown by the dotted outline. The direction of the movement is represented by the heavy arrow. As a result of this movement of the wire-stretching pliers a dead bend is produced in the wire between *A* and *B*. All through the remaining portion of the lingual wire from *A* around through the incisal section and the premolar section of *C*, we have an active spring which

tends to return to its original position. As the alignment wire from *A* to *C*, which possesses the active spring produced by the pinch and movement of the pliers from *1* to *2* returns to its original position, the molar *B* is tipped as shown by the dash line which is a rotation of the crown lingually and the apices buccally.

If a reverse movement of the molar is desired, or a movement where the crown is moved buccally and the apices are tipped lingually, it will be possible to produce that movement by placing the wire-stretching pliers at the position *1* as shown in Fig. 20, and as the pinch is made, the handles are moved gingivally to the position shown at *2*. This again results in a dead bend between *A* to *B* and an active spring between *A* and *C*. As the alignment wire from *A* to *C* returns to its original shape, the crown of molar *B* will be tipped buccally, and the apices will be tipped gingivally or lingually. Fig. 21 shows the possibility of producing a tipping of the crown of the molar buccally by means of producing a torsional spring in the premolar section of the alignment wire by the proper use of the wire-stretching pliers. In addition to this tipping of the crown of the molar buccally by making a pinch in the incisal section of the arch as shown in Fig. 21 at *D* at the section *E1* will be lengthened to *E2*, thereby producing a lateral extension of the premolars and molars. The pinch made at *A* while the

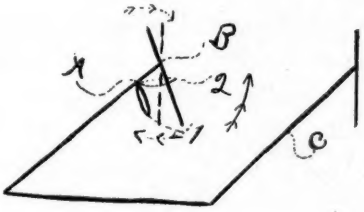

Fig. 19.

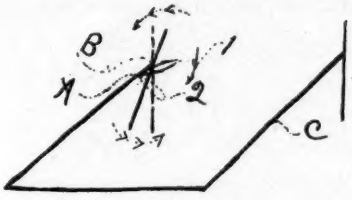

Fig. 20.

handles of the pliers are moved gingivally will result in a torsional bend which will move the crown of the right molar buccally, while the pinch at *O* will carry both molars buccally, but the one on the left side will be carried buccally without any occlusal tipping.

In some instances, it is desired to produce an elevation of one of the molars which can be accomplished according to the illustration Fig. 22. By placing the beaks of the wire-stretching pliers in the incisal section at *1* and rotating the handles gingivally to *2*, there will be produced a torsional spring in the alignment wire which will result in a change of the right side of the wire from the straight section shown at *MR* to the dash line. In other words, the molar on the right side will be elevated and there will be an equal tendency for the molar on the left side to be depressed, but owing to the difference of resistance, no movement of the left molar will occur.

I have endeavored to show the various movements which can be accomplished by the wire-stretching pliers by pinching the alignment wire in different positions, also how the change can be modified by movement of the pliers during the time the pinch is being made. If one has mastered the various possibilities of the wire-stretching pliers, practical application of the various movements which have been indicated can be made. It is equally necessary to know how

these movements are occurring and may occur in order that these changes may not be produced in cases where they are not desirable.

As a word of caution to all, the wire-stretching pliers present great mechanical possibilities and provide a force which is capable of moving teeth in many directions if properly applied. It must also be remembered that in using the wire-stretching pliers, every pinch on the wire will produce some movement and

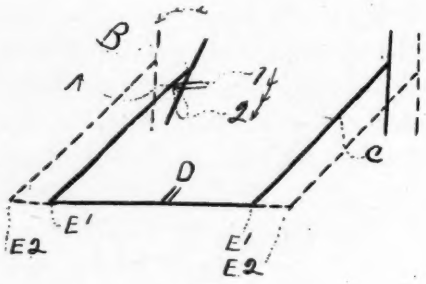

Fig. 21.

this movement will not be noticeable until a certain length of time has elapsed. It must be remembered that the force which you place on the wire as the result of a pinch may not be manifest or noticeable at the time the pinch is made, but nevertheless it is going to produce something in the end. I believe there is no instrument that offers so many possibilities of practical application as the wire-

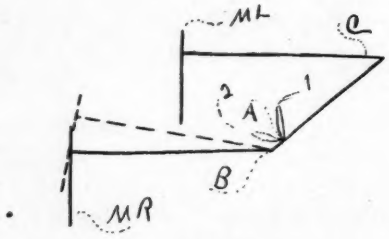

Fig. 22.

stretching pliers, and I am absolutely certain that there is no force capable of producing so much harm if improperly applied.

In closing, I wish to acknowledge the advice and assistance of Dr. Lloyd S. Lourie in preparing these diagrams, and to state that all of the mechanical principles outlined in this article are employed by him in his practice.

THIRD MOLAR INFLUENCE IN ORTHODONTIC CASES*

By Dr. H. L. Morehouse, Spokane, Wash.

IN SELECTING this subject for my contribution to this meeting, I did so because it was the one I had planned on presenting to you last year. In the meantime, however, Dewey published an article on the subject in the September issue of the *International Journal of Orthodontia,* but I still feel this subject needs further emphasizing. This I shall endeavor to do with a short paper and reports of a few cases in my own experience, where the third molars were extremely active.

From a dental standpoint, the question of third molar influence does not arise until between eighteen and twenty-five years of age, while from an orthodontic viewpoint, the question should be considered as early as twelve years.

Authorities on comparative anatomy claim that we are gradually evolving to a state where we will eventually be saved all the annoyance of these once essential members. Then think what a pleasure it will be to practice our chosen profession.

If we will watch our preventative cases closely during the period of eruption of the first permanent molars, we will find the same influence being exerted that later gives us trouble from the third. In fact, the pressure is a normal one, as it is nature's way of creating the stimulus necessary for the proper development of the bones of the two dental arches. From a careful study of the attending conditions, as well as the position of the erupting second molars, in Class II Division I cases, I believe we will find that in a great many instances, the action of the second molar will be found to answer the question of the etiology of these cases. In many cases where the second premolars have been locked out, we will find the action of the erupting second molars have forced the firsts mesially in the same manner and with the same result as is later brought about by the action of the third molars. The extent of the damage resulting from these erupting forces, depends on the amount of resistance the teeth anterior to them exert; their shape and form of the cusps, as well as the occlusion of the teeth. In some cases it will be found that the second molar force began very early, with the result that the first molar is occupying the space that belongs to the second premolar. The consequence is that it (second premolar) is either impacted or has been forced out of its normal position in the arch.

In cases where this has occurred, naturally the germ of the third molar has taken a position much further mesially than it otherwise would. If, then, we endeavor to establish normal occlusion without an extraction, the condition will be complicated more than ever. This must have been the experience of James Robertson to whom Weinberger refers in his *History of Orthodontia.* Robertson published, in the *Dental Review,* of London, in 1895, an article on

*Read before the Pacific Coast Society of Orthodontists, San Francisco, Calif., Feb. 18, 1918.

the *Cause of Irregularity of the Teeth* in which he says, "The growth and advent of the third molar, when an insufficient space exists for its development is not only a source of great suffering, but frequently the immediate cause of irregularity by the pressure exerted toward the anterior teeth of the mouth which until their development, presented a regular denture." Thus we see that the third molar action is nothing new, but until the last few years it was overlooked by us, as orthodontists, in our anxiety to perfect the treatment and mechanical devices.

I have models of three normally developed cases of about twenty-five years of age where the third molars, in erupting, had forced all the other teeth mesially, crowding one lower incisor out of the line of occlusion; another of about the same age in which the upper centrals were gradually lapping. I advised the extraction of the thirds and a year later the young lady reported that the condition had corrected itself.

It is very apparent that this offending third molar has been the cause of a great many of the failures which, before the advent of the x-ray for diagnosis, we could not account for.

Though this may be the case, it does not necessarily mean that we are not justified in urging the treatment of cases at an early age, (rather the opposite,) for in the treatment of preventive cases, I believe the patient is getting the most for his money and there is less likelihood of any slipping in the future. With the use of the x-ray from time to time, we can guard against any mesial movement by means of retainers until such a time as seems best for the removal of the offending members or some other tooth as the case demands. However, in the preventive cases, I feel there will be found the least amount of trouble from this source, for the development is nearer that of Nature's work, unassisted by mechanical devices.

About seven years ago, I recall the first case in which I suspected the trouble, that of a young lady eighteen years of age with a Class II, Division 1, Subdivision, in which the upper right cuspid had erupted labially. After a number of months' treatment, I felt that the distal movement was not what it should be, and on x-ray examination, the picture disclosed an impacted upper third molar. This was removed and the case finished splendidly. Later she had the others removed and I experienced no trouble with the retention. This did not arouse my suspicion except for cases of about that age or older.

The next case is another Class II, Division 1 of a girl fifteen for whom no x-ray was taken until the later part of the treatment, disclosing the condition shown in Fig. 1. Here two actions were taking place; the lower thirds were locked distal to the seconds, forcing the first and seconds into position of supra-occlusion; the upper thirds were badly impacted above the seconds making it impossible to get normal mesio-distal relation. I had the upper seconds extracted and the lower thirds removed and feel sure that no further trouble will be experienced.

Fig. 2, a Class II, Division 2, case shows trouble only in the lower in which the thirds are causing supraocclusion of the first and second molars, giving the effect of infra-occlusion of the rest of the teeth. The worst of this case was

Fig. 1.

Fig. 2.

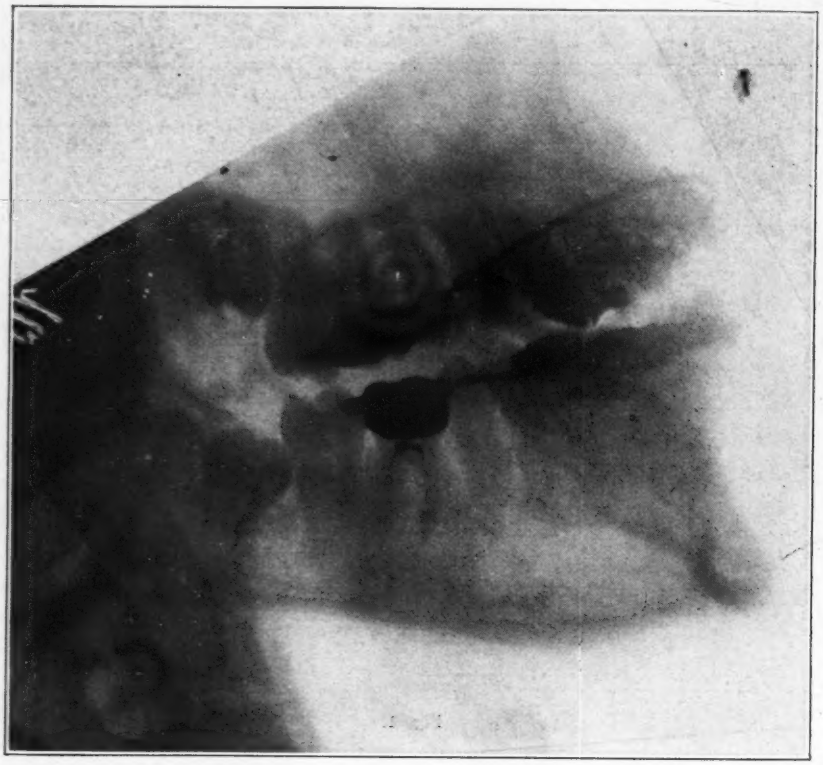

Fig. 3.

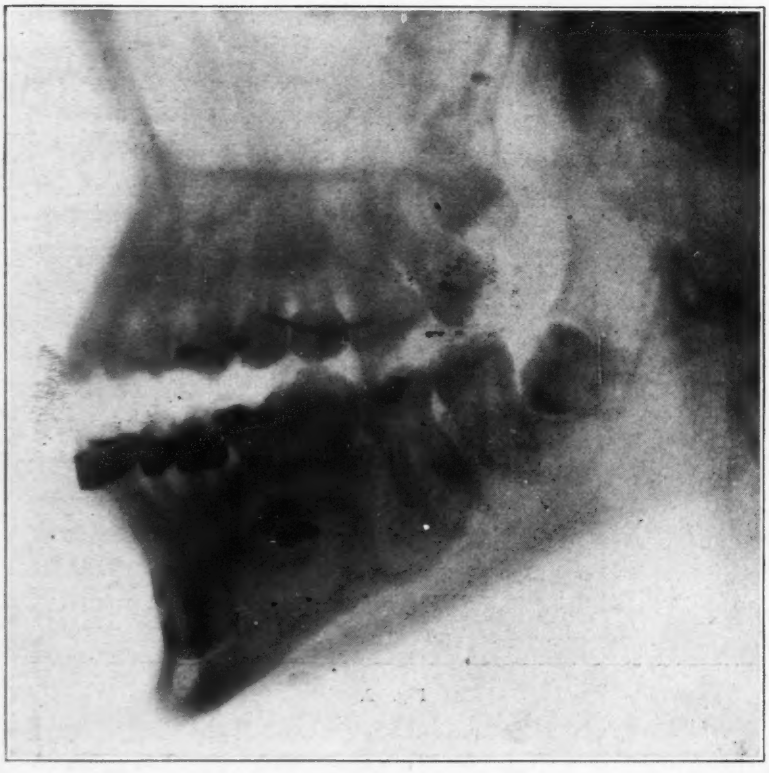

Fig. 4.

Fig. 5.

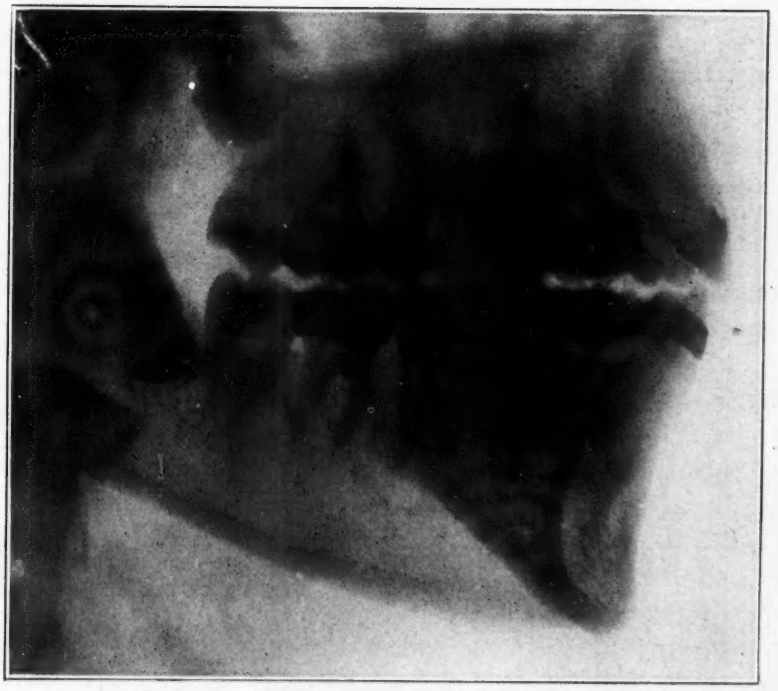

Fig. 6.

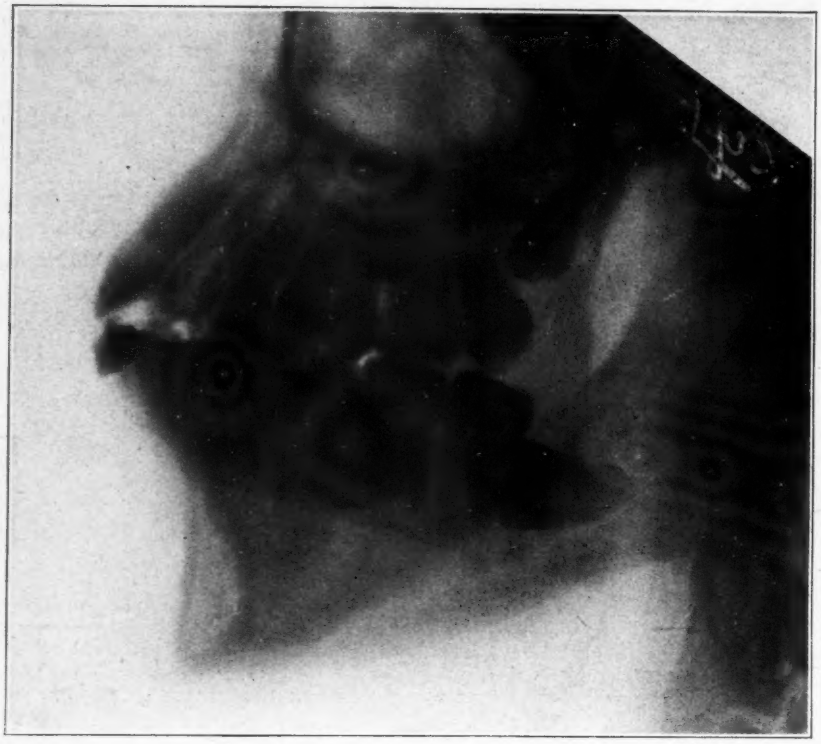

Fig. 7.

Fig. 8.

that it did not develop until six months after retention and then the parents delayed having the lower thirds removed until the tissue had been built beneath the other molars, with the result that the case had to be retreated as one of infra-occlusion in the incisors.

Fig. 3 is of a Class I case which during treatment developed a supra-occlusion of the first and second lower molars, the cause of which is clearly shown in the x-ray, but unlike the second case, the lower thirds were removed at once and the appliances left off for about three months with the result that the teeth settled back to normal themselves and have given no further trouble.

Figs. 4 and 5 are of Class II, Division 2, cases, mutilated on one side with an unerupted upper second premolar on the other. Fig. 4 shows the upper second premolar in position, but the operation of opening the space for the unerupted tooth complicated the impaction on that side. It also shows a badly impacted lower third, which condition is also found in Fig. 5. These lower thirds were causing a movement mesially of all the lower teeth. I had both lower thirds removed, also the upper right second in Fig. 4 and no further trouble is anticipated.

The question will arise in most minds at once, would it not have been better to have waited until the second premolar did erupt and extract that, thus saving the patient the long treatment. This might have been best had the x-ray disclosed the impacted lower thirds at that time. In some ways the condition shown in Fig. 5 answers the question.

Fig. 6 is of a Class I case with the usual prominent cuspids of a boy of thirteen. The father of this boy was a "Doubting Thomas," and in order to be certain that nothing went wrong, I had used every precaution in the treatment. After retaining the case for about a year, I removed the upper retention, feeling certain the occlusion would hold the case. Four months later I discovered I was falling heir to a beautiful Class II case and immediately upon x-ray examination the reason was plain; it showed badly impacted upper thirds. It also disclosed the lower thirds in a position which, from experience, I knew would give trouble later, so had those removed also.

Fig. 7 is one of the most disheartening of any I have ever had under treatment. It is a Class II, Division 1 case which I treated some eight years ago. The girl was seventeen years of age. After correction of the case, I held the arches under retention for about two years. They were then gradually removed. The arches showed no signs of buckling for nearly three years, when they started. As soon as I discovered the condition, radiographs disclosed what you see on the screen. The worst of it all is that she refuses to have them removed and I have disclaimed any future responsibility for the case.

Fig. 8 is not one of the third molar trouble, but one which is very seldom encountered, that of a cystic odontoma in a girl nine years old, which I thought might be of interest to some of you.

I feel that radiograms should be taken at regular intervals of six months to a year, according to the condition that shows in the first picture.

In closing, if there are any who have been in doubt as to the trouble these

impacted third molars can inflict on our young patients, I trust that these few illustrations will have emphasized the danger which lies in wait for them if they do not heed the signs.

DISCUSSION

Dr. Wm. Cavanagh.—You have listened to one of the papers that should make us glad to be here. To detect just such unseen and unsuspected sources of malocclusion as Dr. Morehouse has pointed out will doubtless save many of us as much time as is required to make the journey to San Francisco and return. I think the paper is deserving of a very thorough discussion.

Dr. Robert Dunn.—It is rather difficult for me to discuss this paper as I am not in a position to do it justice. The Doctor states that from the orthodontist's viewpoint the influence of the third molar should be considered about as early as the twelfth year. I believe there are instances where it would be well to consider this matter in patients even younger than that. All with any considerable practice in orthodontia have doubtless had some very sad experiences with third molars. Work carefully done has been upset. Retainers have been removed and the patients have returned to have the appliances replaced and readjusted, and the statement is made, "I was in the care of Dr. ——, and had my teeth corrected and they would not stay; I am not going back again, etc." Students of comparative anatomy claim the time is coming when we will not be troubled with third molars, but I think this is a dream, and as long as we live we will have third molars to contend with. I do not believe the race is losing any of its teeth.

Dr. Morehouse did not make much reference to Class III cases. I have handled a great number of patients, having this type of malocclusion. It seems to have been my lot to treat many of them. In every one of these cases you can see the influence of the third molar after a certain age. Unless you have those teeth removed you will probably not succeed in completing the treatment of these cases for a number of years. Even if the teeth are removed, in case it is not done early enough, the tendency is to revert.

One point not mentioned in the paper is a combination of influence of the third molar and bad dental restorations. Gentlemen, there are many failures in orthodontia due to faulty dental restoration. A wrongly formed inclined plane,—incorrect contact points, etc., and you have the pressure of the third molar on the second molar, tending to move the second molar lingually, or buccally. The first permanent molar, or premolar tooth may be affected.

Dr. Morehouse spoke of impacted premolars. The question arises, what are we going to do with those cases? In case the third molars are not already impacted, will they become so through our operations to make space for the premolars?

Dr. John R. McCoy.—I think that as has already been stated this paper is going to be worth a great deal to us. I have always realized that the third molar must have its influence in causing a recurrence of malocclusion, and I can look over some of my cases right now and see where the extraction of those teeth may be of immense value.

Speaking of Class III cases, I believe from now on there will be more and more of those lower third molars removed. I shall attend to it in my own practice, as a matter of precaution.

The value of the x-ray in orthodontia is certainly represented in this work, and I think most of us have used it far too little, usually because it puts the patient to a little expense or trouble, when probably it would save the patient a great deal of trouble and ourselves much expense if we used it more.

Dr. Suggett.—I think Dr. Morehouse's paper will save me a lot of trouble in the future. I think the idea we got a few years ago of the maximum number of teeth in the mouth, with every tooth in its place, was a bit exaggerated, and we have been afraid of breaking the rule and of being independent enough to remove any teeth. There are cases where the removal of the second molar will result in its replacement by the third molar, and in other instances the third molar should be removed. I have had many cases where I am sure such a procedure would have saved me much trouble. Two years after treatment I have had buckling up of the cases, and a return of the teeth to their abnormal positions, due, I am sure, to the influence of the third molars.

Another interesting question in this connection is, When does our responsibility cease? The question is a rather debatable one.

Dr. Mann.—I think the Society is to be congratulated in having a paper of this sort presented to it. I can now see how much trouble might have been avoided in my own

practice earlier had I come into the light as Dr. Morehouse has done. I however agree very fervently with Dr. Dunn, that these cases should be observed even earlier than twelve years of age. In one case recently under observation in my practice, that force was obviously in operation at the age of seven to eight years to such a great extent that the first molar was impacted behind the second deciduous molar and the second deciduous molar had become eroded so that a shelf was formed which held the first molar in an impacted position, and did not permit of its eruption.

As to the question of the restoration of lost structure, mesio-distal diameters, etc., I think the greatest trouble we have is what is known as "plus contact points." It is a method followed by dentists who are doing what is now known as very modern dental restoration. It seems to me if a better understanding of normal mesio-distal diameters was had among dentists, we probably would have much less trouble in the question Dr. Dunn brought up.

Dr. James D. McCoy.—Mr. Chairman: The baneful effects in these third molars in producing recurrent malocclusion, has been very forcibly brought to my attention in many cases which I have treated. In an attempt to work out some practical method of preventing the trouble, I have frequently made radiograms at the time retainers were adjusted, in order to locate the relationship of these teeth to the second molars, and have impressed this fact on the patients, that the retainers must not be removed until those teeth had either erupted or until their eruption can be foreseen by subsequent radiographic examination and the diagnosis made that they may not afford any complications. I observe another precaution in all these cases that remain under my observation. I construct a retainer on the lower arch from cuspid to cuspid, with a lingual wire extending far enough distally to include the surfaces of the first premolars,—so that that portion of the lower arch will be supported against the pressure of the lower third molars. I have not experienced much difficulty with the upper third molars, except that these teeth may have influenced the eruption of the upper second molars, pushing them forward and causing them to erupt in buccal relation to the lower teeth.

By the construction of the lower retainer referred to, and impressing the patient, that the retainer must remain until the third molars have erupted, I have avoided many recurrences that formerly I was unable to prevent. Following out our present plan in the office of making a radiographic survey of all cases prior to treatment, as a routine part of the examination, we will discover these complications and be able to avoid trouble very often. Where there is a mixed dentition, with deciduous molars still present, etc., we make radiograms, using the extraoral method, getting an adequate survey of both upper and lower arch, embracing all teeth posterior to the canines, and if the third molars present any complication we can check up on these teeth later.

I think the most common form of recurrence is the trouble to be found in the lower arch in the crowding of the incisors and canines. A number of cases have left my regular care at perhaps the ages of ten to twelve years—with all retainers removed. They have been kept under observation from time to time, seeing them over a period of two or three years,—long enough to be sure no future trouble would recur. Then I have seen them three to five years later and found this crowded condition of the lower teeth present, and even although the upper teeth do not bunch up, they are influenced by the relationship of the lower teeth because they usually accommodate themselves to the lower teeth. So that the construction of this little retainer, giving the lower arch support, including the canines and first premolars, saves me a great deal of trouble.

Dr. Carter.—Mr. President: My attention has been called to the influence of the third molar in these cases of malocclusion, because of the fact I do a great deal of radiographic work. As a routine in my office, whenever I accept a case for treatment, the first thing I do is to make a complete set of radiograms, and because of this fact, and also because of the fact I do radiographic work for members of the profession, the matter under discussion has been of much interest to me.

I have a case in mind where a dentist sent a patient to me to see if I could discover why the second molars had not erupted. The patient was about twenty-five years of age. On making a radiographic examination I discovered the third molars were completely inverted and had depressed the second molars on both sides in the lower jaw. They had locked on the cusps of the second molar, so those teeth never erupted. You could see the influence of the depression. The roots of the teeth were locked just like a bow-legged man, and that happened on both sides.

Dr. Dunn mentioned the influence of imperfect restorations, i. e., as to the mesio-distal diameter of the tooth. I believe a good many cases of recurrence of malocclusion

are due to these improper restorations. I have noted many cases of relapse, due I am sure to the causes mentioned here this morning. I have taken a great deal of pleasure in explaining to such patients that have chanced to come under my observation, the reason for the trouble. Naturally they seem to think it the fault of the orthodontist, and because of the fact the dentist does not understand why we have these recurrences I sometimes think it would be a very good thing if we could give the dental profession some education along that line, and then they would not be so prone to blame the orthodontist for cases that may have relapsed.

Dr. Solley.—I would like to ask a question with reference to the last case that Dr. Logan operated on. Did you see the splint used there?

Dr. Morehouse.—No. He said he reenforced the jaw before operating.

Dr. Cavanagh.—It seems to me this paper would explain why we are disposed to allow the retainers to remain longer on the lower teeth than the upper. Impactions of the third molars occur more frequently in the lower arch than in the upper, and the anterior teeth are often crowded back into imperfect alignment in spite of proper retention. It occurs to me now that perhaps the third molar has been causing many of my complications, and I shall patronize the radiographer more often hereafter.

Dr. Morehouse.—With regard to the point spoken of by Dr. Suggett, as to the absorption of roots, I think we should be very careful not to make too quick judgment as to the radiographic appearances regarding the absorption of impacted teeth. I recall two instances of the discovery of impacted lower third molars, and the radiograms showed as pretty as could be an apparent absorption of the distal surface of the root of the lower second molars—a complete cupping out. This was both from my own diagnosis and that of the radiographer, and it was thought the second molar should be removed. We removed the tooth and there was absolutely not a particle of absorption. I have seen a number of instances where absorption seemed apparent in the other teeth, where, as a matter of fact, there was none. So I should want the radiographs made from different angles, etc.

Dr. Wilson showed me in San Diego radiograms of a case of an impacted upper canine in a boy of fifteen years of age. The tooth occupied a horizontal position, and apparently one-third of the lateral incisor root was absorbed. He had anticipated making some tooth movement and anchoring to the lateral, but the radiogram caused him to feel he did not have enough support there. I told him I doubted very much if he would find the absorption which the radiogram seemed to show. We have to be very careful, lest we find we have been misled, even though radiograms are made.

In regard to the impacted third molars as shown on the slide we all recognize the impacted canine and its influence in causing malposition of the lateral incisor—especially in the upper arch. The canine lying on the apical end of the lateral causes it to tip into an abnormal position. I think if taken early enough, we will discover, as Dr. Dunn suggests, even earlier than twelve years,—we will find very often the third molar exerts a tremendous influence on the shifting mesially of the other teeth. Invariably the root of the canine is in its normal position, and the cusp of the tooth is in a mesial position.

I hoped the discussion would bring out the question of whether to extract the third molar or the upper second molar. I think it better to lose the upper second molar in some cases, dependent on the condition of the mouth as to caries, etc. When I first advocated the extraction of the upper second molars to the profession in Spokane, they threw up their hands and thought I was too radical. They thought the upper third molar is a useless organ, even after it erupts. I combated that with the argument that it was a great deal like a bad apple in a barrel, and that it is a question of environment. I stated if the third molar takes the place of the second molar, the third molar would have a better chance of being a good tooth than the second molar, as it came at a time in life when the system was not being drained, and it had a better opportunity of being thoroughly calcified than at any other time in life, and thus it should be a better tooth than the second molar. And so I feel in some cases I am doing a patient greater justice in removing the upper second molar rather than the third molar.

Dr. Carter.—I would like to ask Dr. Morehouse in relation to this. Was it a lateral in Dr. Wilson's case?

Dr. Morehouse.—Yes.

Dr. Carter.—What was the position of the lateral in relation to the central?

Dr. Morehouse.—Normal.

Dr. Carter.—In normal position. I was going to suggest an error might be made on account of foreshortening.

THE RELATION OF THE DEVELOPMENT OF THE NASAL FOSSA TO THAT OF THE ORAL CAVITY*

By J. T. Dowling, M.D., Seattle, Wash.

THIS subject has always been of very great interest to me as a doctor and a rhinologist. It has a humanitarian and social side. The condition begins in the early life of the child, causes untold misery and distress, attacks the individual when he is least able to protect himself and worst of all, can be prevented absolutely by proper care and treatment by parent, doctor and dentist. So our duty is education, prevention and treatment.

General Considerations.—First, congenital deformities of dental arch. I will say that this phase of the question may be passed, by mentioning cleft palate, complete and partial, and has very little to do with the scope of this paper.

In discussing this question before your dental society, I will not presume to enumerate the various dental conditions or deformities as they may exist, since you gentlemen are much more familiar with the conditions than I could possibly be.

In the mind of the rhinologist and laryngologist the most important cause of nasal and dental deformities is adenoids, or hypertrophy of the pharyngeal tonsils. The pharyngeal tonsil, as you know, is situated in the nasopharynx. It is a gland and a physiologic structure. It becomes a menace to the health and development of the child only when it becomes enlarged and pathologic thereby causing obstruction to normal breathing. As this tissue usually atrophies before adult life, attention is generally directed to this structure in early childhood. Whether the enlargement is congenital or occurs soon after birth matters little, as the main symptom demanding relief is the obstruction to nasal respiration, which, if unimpaired as the process of development goes on, has much to do with the regular formation and contour of the face and dental arch. The respiratory acts through the nose, as well as the action of the muscles controlling the nasal orifices, is a factor of importance in controlling the size of the nasal cavity. If this function is interfered with by any obstructive lesion, as would occur in adenoid vegetation, and that obstruction is allowed to remain until the osseous nasal framework has become firmly fixed, the capacity for nasal breathing is permanently fixed; and even should the glandular structure causing the obstruction be removed, while the ablation may relieve the nasopharyngeal symptoms, it can not possibly increase nasal respiration, other than by lessening the engorgement of the submucosa subsequent to such obstruction. This fixity of the bones of the face may leave the individual a confirmed mouth breather. This is the reason why, as frequently happens, the adenoid operation does not cure the child of mouth breathing although the ablation of the adenoid tissue may be perfectly done.

The effect of impaired respiration, due to postnasal obstruction is also manifested in an ill-formed maxillary arch, with marked irregularity in the

*Read before the King County Dental Society, Seattle, Wash., April 2, 1918.

arrangement of the teeth. The irregular development is largely caused by the repeated contraction of the muscles controlling the nasal orifices, necessitated by the forced nasal inspiration and snuffing. By the drawing down of the facial muscles the upper jaw is retracted and the contour of the upper arch is altered. The hard palate, then, instead of forming a perfect dome, has its anterior portion tilted out and its upper portion, at the base of the nose, drawn in. Without this interference the pressure of the air within the natural passage counterbalances that upon the external surface and normal development takes place. This, of course, will occur only when the obstruction takes place in early life, before the bones are firmly united. This irregularity in the arch will produce unevenness in the development of the teeth, causing their eruption high up in the alveolar process, or, if placed in the arch, they will be crowded and irregular. If the eruption occurs high up it will add to the protrusion of the upper lip, increasing the facial deformity so characteristic of adenoid obstruction. Inherited tendency to adenoids is often, in reality, the inherited family nose, children with the narrow slitlike orifice being more prone to thickening of the adenoid structure than those having a wide open nostril. As a rule, this postnasal obstruction, due to adenoids, interferes with both nostrils, yet occasionally it is one-sided. I have seen several such cases and unless the obstruction be removed early in life, irregular one-sided development and uneven facial contour and dental contour is observed. This condition then may precede and be the cause of anterior nasal stenosis, or the latter condition may be a factor in the enlargement of the adenoids.

In clearing the nasopharynx of adenoid vegetation, one must be very careful to completely remove all of the vegetation or they may recur. I wish to most earnestly emphasize the removal of the faucial tonsils at the time of operation on the adenoid enlargement. Many times I have found that the adenoid obstruction had recurred simply because some of my fellow-practitioners had neglected to remove the tonsils at the time of the adenoid operation, either through ignorance of the true pathology of the condition or on the plea that the child could not withstand the combined tonsil and adenoid operation. To my mind this is all wrong, first because of the greater tendency of recurrence of the adenoids, and secondly, it subjects the little one to an additionl subsequent operation. Unless there is a very clear contraindication to the combined operation of tonsillectomy and adenectomy, I refuse to operate now on adenoids alone.

The age of most frequent enlargement of adenoids is between the third and tenth years, although they may begin before the third year or exsit at birth. From the tenth to the fifteenth year the structure undergoes physiological atrophy. This may occur even if the tissue is not enlarged, as well as when it is the subject of pathological changes. Sex is not associated as an etiological factor.

The fact that enlargement may occur in several children in the same family, involves the question of heredity only as to the inherited family nose or lymphatic enlargement. This is, in my mind, another explanation for the occurrence of malocclusion in all or several children of the same family. In constitutional dyscrasias, as in the syphilitic or tubercular condition, there is

a tendency to general glandular involvement, which is increased by the fact that from the lessened physiological resistance and diminished vascular tone there is a tendency to sluggish circulation in lax structure, especially the mucous membrane. This will tend to engorgement and watery infiltration, more marked where the lymph-channels are numerous. Any condition bringing about anemia will produce this phenomenon.

As we all know, syphilis and tuberculosis in the young have a decided action on the permanent teeth and the formation of the nasal and nasopharyngeal cavities. The former have a special action on the second teeth, the so-called "Hutchinson" teeth which is a common diagnostic point in congenital syphilis.

Climate is an important exciting factor, the enlargement of the adenoid tissue being more common in damp climates or in locations in which there are sudden changes in temperature. Poor hygiene and improper feeding or lack of sufficient nourishing food tend to nasal obstruction and hence nasal deformity and mouth deformity. Children living in cities seem more prone to nasal and mouth deformities than those living in rural districts. This is probably due to the breathing of dust-laden air and to the crowding together in the tenement settlements of our large cities.

I have, you all have, seen the child with nasal obstruction and when I speak of nasal obstruction in the broad sense, I mean adenoid obstruction. The patient is a mouth breather, or at least a "night" mouth breather. The facial expression is characteristic, a dull look to obliteration of the labio-nasal fold, protruding of the upper lip and often the anterior portion of the superior maxillary ridge. The bridge of the nose is flattened and the alæ of the nose are drawn in, due to the constant pulling effort to get breath through the nose. Early the irregularity of the teeth occurs, hence the need of early correction of the condition. The lower jaw hangs, giving the child an appearance of dullness and an inability for concentration of thought or attention. All of the symptoms are much aggravated by "colds." These in turn tend to produce greater obstruction and to lower the child's immunity so that often it suffers from an almost continuous cold and infection.

While the scope of this paper no doubt is very broad, I have tried to take up that portion of dental arch deformity caused by nasal obstruction, due to adenoids. This phase, as a rhinologist, I am best able to discuss. I believe that a large percentage of dental arch deformities, at least 45 per cent, are due to adenoids, and nasal obstruction in the young. There should be a much closer cooperation, not only between the orthodontist and the rhinologist, but between the general dental practitioner and the rhinologist. The orthodontist can not hope for much success in the correction of arch deformities unless all nasal obstructions are cleared away and the rhinologist should endeavor to impress upon his patients the vital health-giving necessity of a good, normal dental arch and proper occlusion of the teeth. The child or youth who starts out in life with a mouth full of teeth that have the setting of tusks, not only has a hard fight from a health standpoint, but from a social one as well.

I wish to take this opportunity of thanking you for the privilege of addressing your honorable society.

REMOVAL OF THIRTY DENTICLES FROM ONE BICUSPID SOCKET*

By Bundy Allen, M.D., Iowa City, Iowa
Roentgenologist, University Hospital, State University of Iowa, College of Medicine

MAY 29, 1917, a woman, aged 23, called my attention to a slight prominence of the gum buccally to the upper right bicuspid region which had not produced any symptoms other than the elevation of the tissue. Fig. 1 is a roentgenogram of the upper right bicuspid region showing the presence of a collection

Fig. 1.

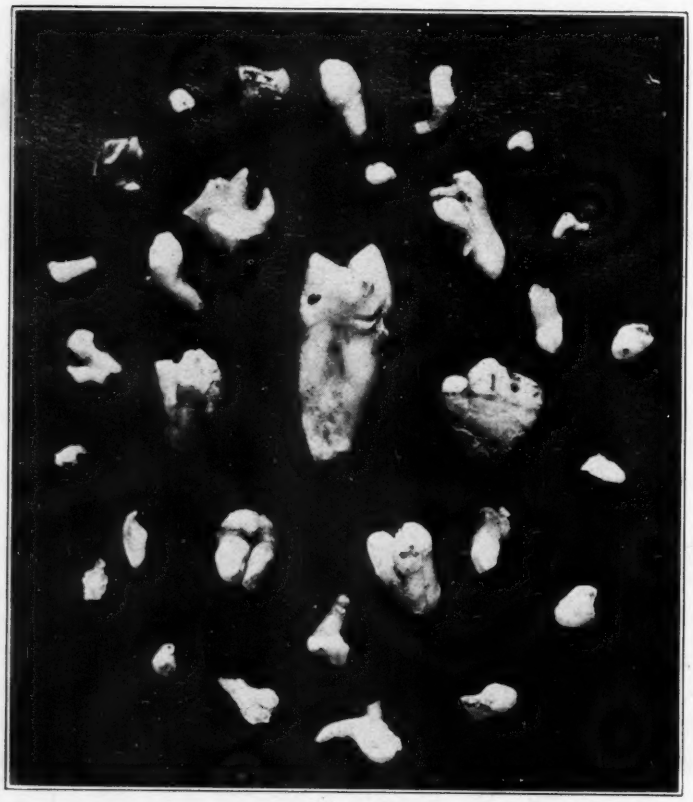

Fig. 2.

of denticles. The patient was referred to Dr. John Voss, of Iowa City, Iowa, who extracted thirty denticles from the first bicuspid socket (Fig. 2). All teeth were present, and occlusion was perfect, excepting for the third molars, which had not erupted.

*Reprinted from The Journal of the American Medical Association, April 27, 1918, vol. 70, p. 1224.

THE HISTORY OF ORTHODONTIA

(*Continued from page* 250.)

By Bernhard Wolf Weinberger, D.D.S., New York City

W. G. A. BONWILL (1833-99) before the Delaware Dental Society in 1863 described his "system" of regulating teeth. In the Proceedings this paper appears under the title of *Orthodontia,* however "on account of its length it was refused publication in the *Dental Cosmos.*"

In 1888 Bonwill read or reread part of this paper before the New York

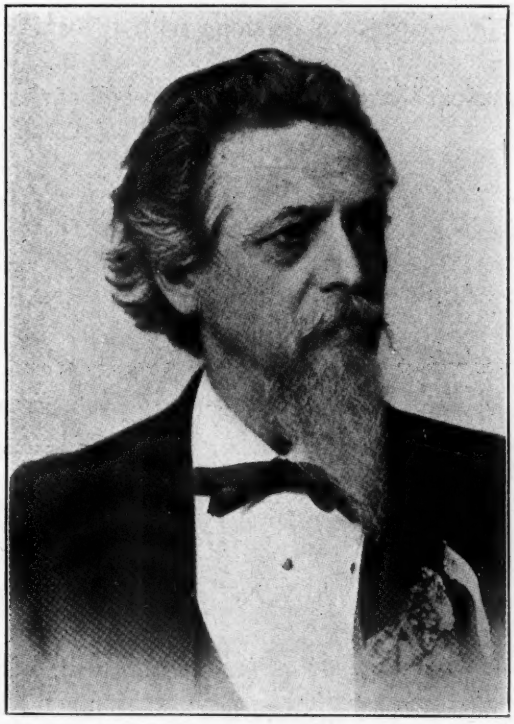

Fig. 1.—W. G. A. Bonwill (1833-99).

First District Dental Society, under *Original Devices for Correcting Irregularities of the Teeth Since* 1854, *Not Hitherto Known to the Profession.* Again on account of its length it did not appear among the First District's Transactions in the *Cosmos.* However, we undoubtedly find this same paper in the *International Dental Journal,* 1889, under *Regulators and Methods of Correcting Irregularities,* in which Bonwill quotes part of the paper read in 1863.

Bonwill said, "My first essay on orthodontia was written in 1862. To make my own history more replete, however, it is necessary to show what I have done in this line of work since 1854. As the apparatus was then entirely new and the practice considered rather radical for the time, and as it has since been revived by others, I shall briefly present them here.

"From the following language it will be seen that the Coffin Plate of rubber was anticipated by me, except that I used silver wire made spiral, and adjustable or detachable from the plate previous to 1862.

"If the inferior jaw, I clasp, where possible, and when not, strike up a plate to cover the deciduous or permanent teeth, as they may be, and operate from this. From the inward inclination of the inferior bicuspids and molars (or molars alone of the temporary set) there will be sufficient firmness gained by making it to press outwards at these points.

"If there are no other means of holding it in the inferior jaw, an India rubber plate made to fit accurately either the teeth or palate, or both; and if you desire, the surface of the vulcanized plate can be roughened to enable the patient to masticate thereon, and screw the spiral springs into this.

"This I seldom use, being bulky and dirty and far more liable to injure the faces of the teeth. More can be done with the spiral springs soldered to a metal plate.

"Instead of contracted jaws from extraction and caries, it is the compressed

Fig. 2.—Silver plate as used by Bonwill in 1863.

Fig. 3.—Arch as used by Bonwill with spiral springs.

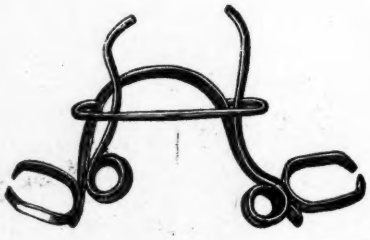

Fig. 4.—Arch and bands used by Bonwill with spiral springs.

alveolar borders, and the want of resistance in them, which prevents normal mandibular action, and consequently healthy nutrition can not result.

"Figs. 2 to 7 show the spiral spring in various phases and which are illustrations of the original apparatus for the correction of irregularities used in illustrating my paper read before the Delaware Dental Society in 1863, above referred to. It will be observed that the 'Talbot spiral spring' is a true reproduction of the Figs. 2 to 7.

"Fig. 2 represents a silver plate made to fit the inferior incisors, and which was tied on a central, to correct a superior central from the inclined projection on the right; the end of the spring acted on the right inferior central to throw it out of the arch.

"Figs. 3, 4, 5 represent metal bands with clasps, with the spiral spring soft-soldered under a metal loop hard-soldered to the band. This retains the temper. These are used on many teeth in either jaw.

"Fig. 5 shows a metal plate with half-clasps fitted to the bicuspids, to hold it in position. The spiral spring is soft-soldered to the plate. This can be

changed to various positions on the plate, and is applicable in cases where it is difficult to place the clasp entirely around a tooth.

"Fig. 6 was made for drawing backward the four incisors of the inferior jaw with spiral springs, adjusted so as not to interfere with the tongue or the superior teeth. The piece at *A* goes over the incisors, and is held by ligatures tied to one or more of the teeth.

"Fig. 7 shows a jack-spring for constant pressure. It may be made in a curve to conform to the hard palate. It is very powerful and effective, and superior to a jackscrew.

"In all these spiral-spring appliances, the spring is tied to the tooth to be acted upon to hold it from slipping; or, in some cases, a hole drilled into the tooth is better.

"*Jackscrews.*—Figs. 8 and 9 represent two patterns of jackscrews which

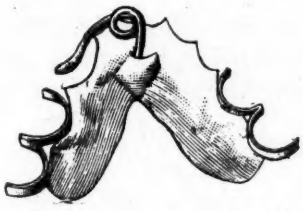

Fig. 5.—Metal plate with clasps and spiral springs.

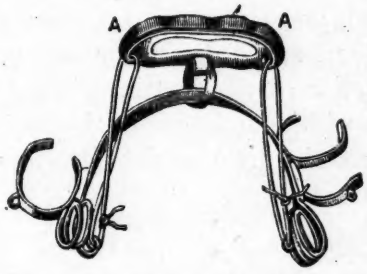

Fig. 6.—Bonwill's method of retracting upper incisors (1863.)

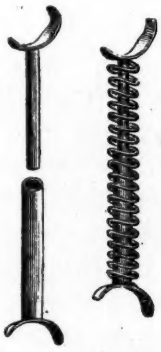

Fig. 7.—Jack's springs.

Fig. 8.—McCollom's jackscrew.

Fig. 9.—C. S. Longstreet's jackscrew.

were placed on the market by Drs. A. McCollom and C. S. Longstreet. As will be seen the one shown in Fig. 8 closely resembles E. C. Angell's device, while the one in Fig. 9 resembles that of Dwinelle. Dwinelle's and Longstreet's jackscrews have but one screw and are more scientific than those constructed with the reverse screws as shown in Fig. 8, not only because they are simpler, but they are more easily operated."

W. H. Coffin before the International Medical Congress in London, 1881, presented a paper describing what he termed *A Generalized Treatment of Irregularities. The Expansion Method* that had been used in practice by his father, Dr. Coffin and Dr. Peter Headridge, since 1869. This method attracted general attention before Coffin read his paper, for we find it described and illus-

trated in an article by Alfred Coleman, in the *Transactions of the Odontological Society of Great Britain,* 1877, page 111, in which he states it had been in use for years. It consisted of a vulcanite plate, capping the teeth, unless held in by clasps, wire or ligatures, divided in the median line of the palate into two halves, which were held together by a piece of pianoforte wire bent in W shape. (Fig. 10.) This acted as a spring and by opening the plate gradually enlarged the dental arch. The advantages of such an arrangement are, "steadiness and uniformity of action, together with the avoidance of numerous visits so necessary in such cases." Coffin said, "A large class, uncomplicated by crowding, in which aberrant teeth are easily replaced, admit of direct and immediate correction by suitable means (a simplification of which will be alluded to).

"Of the remainder, the majority are cases of every variety, in which the teeth—not really too large or too numerous for the jaw they might symmetrically occupy—are, by some chance of their eruption, irregularly disposed, interlocked, and crowded. Of these it may be affirmed, quite generally, that rectification necessitates the movement of many teeth or all, and an altered shape or outline of the dental arch; for any attempted direct adjustment of individual teeth will be accompanied by such a disturbance, more or less extensive. These present the greatest difficulty in regulating by the usual way especially with a

Fig. 10.—Pianoforte wire bent in W-shape for Coffin's plate.

rigid plate; but in the most intricate or the simplest of them, the permissive control of the general tendency of movement during regulation reduces their successful treatment to comparative ease and certainty. This mechanical anticipation of favorable conditions may be illustrated by assuming an incisor to be moved in a crowded arch by any means applied by a plate rigidly embracing the bicuspids and canines, when a certain force in a certain time may complete the operation; but were the plate either abolished, or its symmetrical halves partly independent and free to move relatively in the plane of the arch, less time and force would suffice; and, furthermore, if its halves tend but slightly to separate by an elastic spring reaction, many cases will require very much less time and force to be exerted on the tooth. The action thus stated in its simplest form is obvious from *a priori* considerations, but was observed, it is believed, for the first time by a singular accident.

"Soon after the introduction of vulcanite my father was employing a plate of that material to move an incisor by the swelling of wood. Successive increments of force were resisted until not only was it suddenly in position, but other front teeth were found slightly separated where previously in overlapping contact, the wood (being nearly on the median line), by lateral expansion, having split the plate down the center. In this instance, as will often be the case, previous 'expansion of the arch' by the means usually applied was

certainly not indicated, and therefore not resorted to, although just the slight amount of spreading required was prevented by the rigid construction of the plate. A conviction of this led to a particular method of treating various irregularities, which, as anticipating changes common to them—usually expansive,—has been called, somewhat indefinitely, an 'expansion treatment;' and whose adoption has been abundantly justified by experience.

"The troublesome and delicate operation of 'expanding the arch,' as usually performed, if attempted by the ordinary 'jackscrew' direct, must be accomplished before other regulating action can generally be commenced, and may then prove to be either excessive or unnecessary. The screw is applicable, with care, to severe contraction (though inferior to other means); but undivided plates, however thin and elastic, or hinged plates, however actuated, have not the freedom of movement and adjustability desirable; and the screw is entirely unsuitable for a split plate.

"The little device my father calls an 'expansion plate,' whether used for direct expansion or not, is intrinsically of extreme simplicity, while of complex regulating action, comprising a means easily embodied in any plate of conveniently permitting or assisting (instead of hindering or preventing) during regulation, the inevitable changes of the arch naturally accompanying it, and supplementing ordinary expedients with an expansive characteristic. Its distinguishing function depends on the principle of permitting a relative motion, or maintaining a particular controllable reaction, between two semi-independent parts, usually its symmetrical halves.

"If required, any force, however small, is sufficient, if exerted continuously over a certain distance, with not too rapidly diminishing intensity. Mere repulsion, however, between two points on a split plate, is an unstable system, and uncontrollable. Allowing a certain freedom of motion, means must be provided for restraining it, and maintaining by a yielding guidance any desired degree of parallelism.

"Difficulties attended the first realization of these conditions; but it is found that a wire spring of certain form, if a constructive part of the plate, will itself meet all requirements.

"Modifications of the arrangements found most convenient and satisfactory are exhibited,—after actual use, and in different stages of construction.

"The perfection of the model must be insisted upon, as an entire plate may fit well and securely, and yet both its halves be so loose when divided as to be useless; while, on the other hand, the halves of a split plate may be easily fitted, which before division could not possibly be inserted. The best impressions have been obtained with the preparations of gutta-percha or ballata gum, no other material affording with ease the absolute fit essential for a split plate. Their physical property (when in good condition and at the right temperature) of being elastic and recoverable to rapid changes, reproducing, if inserted slowly and removed quickly, the most intricate undercuts just sufficiently—and affording by the slight contraction in cooling just enough shrinkage—for a thin hard rubber copy to fit tightly. A delicate and elastic vulcanite plate from a good gutta-percha impression—if the model be vul-

canized upon direct, and not touched to accentuate undercuts or correct imperfections—will generally spring over the teeth with so absolute a fit that its removal may even be embarrassing; but until divided its insertion is not usually attempted.

"Trials of the metals and their alloys proved the superiority for springs of apparently so undesirable a material as steel.

"The almost insuperable difficulty of satisfactorily tempering bent soft steel without deformation of shape was obviated by the use of pianoforte wire, as possessing every uniform texture, temper permitting it to be fashioned and used without heating, and a surface hardness and burnish which greatly tend to its preservation. To coat this wire with other substances was found unnecessary and undesirable. The behavior of steel to the fluids of the mouth is such that, if hard and bright at first, and continuously immersed in average saliva, it generally assumes a black polished surface, the smooth, fairly-adherent tarnish being apparently insoluble. A diameter of between three- and four-hundredths of an inch (about 0.035 inch) is most suitable, as of this a convenient length of from one to two and one-half inches exerts an appropriate

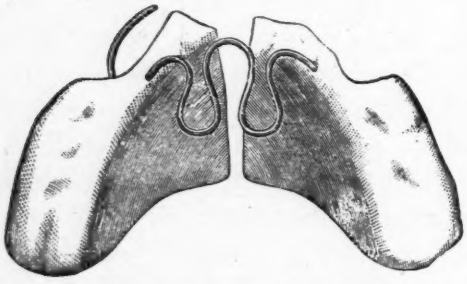

Fig. 11.—Method used to expand upper arch by Coffin.

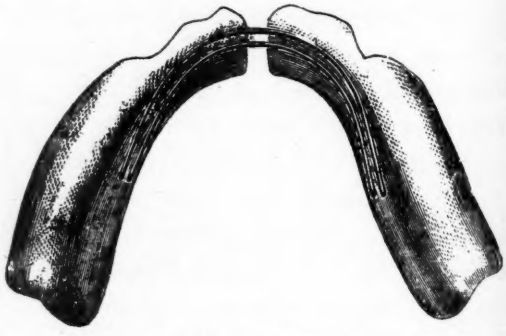

Fig. 12.—Lower appliance.

tension in average cases. The force, varying inversely as the length, may be thus determined within those limits, beyond which a different size is required. Figs. 11 and 12 will give a clear idea of this appliance.

"Great credit is due, for working out certain details of the expansion plates, to Peter Headridge, of Manchester, for many years assistant to my father. This gentleman even obtained a patent for some constructive particulars, which, however, he very advisedly abandoned. The curious are referred to specification 1101, 1869.

"In final justification, the advocates of a method they find to simplify, and trust may extend, the treatment of irregularities appeal to their record of results, which—of whatever real importance or value—would have been difficult or impossible to otherwise attain; and have ventured at such length to detail their procedure, for confirmation or criticism by others.

"The paper was illustrated by more than five hundred old, regulating plates, which had been actually used, about four hundred being 'expansion plates,' upper and lower, symmetrically and unsymmetrically divided, of which nearly two hundred were 'simple expanders,' some two hundred embodying

other regulating devices with 'expansion;' the remainder showing the application of pianoforte wire in ordinary plates for general regulating purposes.

"There were also specimens, with demonstrations, showing at different stages details of their mode of construction.

"The models exhibited in the Museum of the Congress, at Burlington House, of forty typical cases (recording by three or more casts to each the condition before, during and after treatment), were classified as illustrating—

1. Expansion auxiliary to ordinary regulating.
(a) In simple crowding.
(b) For rotation and alignment.
2. General expansion.
(a) For operative treatment of caries.
(b) For misarticulation.
(c) Versus extraction of misplaced teeth.
(d) For prominent incisors.
(e) For contracted, narrow, or misshaped arch.
3. Applications of steel wire to every kind of ordinary regulating.
(a) Alone, without plate or accessories, for alignment or rotation.
(b) Combined with elastic ligatures.
(c) With an ordinary plate for moving, shortening, lengthening, and rotating teeth.
4. Combinations of the above.

John Stockton Hough in the *New York Medical Record,* 1873, on *The Laws of Transmission of Resemblance from Parents to Their Children* claims that "the question of resemblance of children to their parents is one which many ancient and a few modern authors have found a field for much close observation and profound philosophy, carrying their discussions and deductions to all possible degrees of differentiation and detail. Some of their reasons and conclusions as to causes are scarcely plausible, but many of them bear evidence of close observation and careful consideration, for modern research has in several instances discovered proximate causes which fully corroborate these ancient opinions.

"It is the object, then, of this paper to bring before the reader such facts as are at hand to determine the general laws which are brought to issue in the following questions:—

"1. Do children derive their resemblance and inherit diseases more frequently or more easily from their mothers than from their fathers?

"2. Are males more apt to inherit the diseases of their mothers, and females those of their fathers; or is the reverse the case?

"3. What are the laws of physical and physiognomical inheritance?

"4. Is there any constant relationship between the physiognomical resemblance of an individual to an ancestor, and the likelihood to the same constitutional affections, or the reverse?

"The various aspects of resemblance by relationship are as follows:—

In General.—"1. Children resemble their mothers more than their fathers.

"2. Males resemble their mothers, and females their fathers.

"3. When children do not resemble their parents, but their grandparents, males resemble their maternal grandfather, and females their paternal grandmother.

Exceptionally.—"1. Children resemble their fathers more than their mothers.

"2. Males resemble their fathers, and females their mothers.

"3. Male resembles paternal grandparent, female maternal grandparent.

"4. Offspring resembles male by whom female was previously impregnated more than its natural father.

"It seems therefore from all authorities cited to be pretty generally believed that mothers impress their children of both sexes with their physical and moral peculiarities, their constitutional tendencies and hereditary diseases and defects; in short, a general resemblance more marked than that derived from their fathers; and it is not at all surprising that this should be so, for the child is for a considerable period, amounting to at least two years, under the exclusive control and influence of the mother and her varying physical condition during this time."

"In the first place, it may be well to inquire, when and where either parent begins to impress the product with a resemblance of themselves. For convenience we may divide the time and place of impression into four parts, viz.: 1. Impression on either element before fecundation. 2. Impression from the instant of fecundation until the product leaves the Graafian follicle. 3. During gestation. 4. During lactation. At each one of these periods the ovum or product of conception usually receives impressions, but most in the second, or indeed principally there, as some authors have it, for they say that both resemblance and hereditary disease are communicated during this period. Constitutional diseases and peculiarities are probably communicated during this time, though the period of gestation must be reckoned to have great influence on the tastes, inclinations, and qualities of the physical and mental faculties.

"It is quite probable that the ova of the female have an initial existence, as primordial cells or germs, at a very early period in the life of the child, and are in some degree capable of receiving and retaining impressions which may influence the products derived from them.

"On the other hand, the spermatozoa are probably not in a condition (if indeed they have an existence) much before puberty to receive or retain the result of impressions made upon the man. So then, before impregnation, the female element has, in all probability, been subjected to the varying physical conditions of the woman for a much greater length of time than the male element has been to the varying physical states of the man; and the former is, moreover, much more susceptible to such impressions than the latter. Some may think that the ova are not susceptible of being influenced by such methods as I have suggested; to these I can only point to the great difference in appearance, constitution, viability, tastes, and inclinations of children by the same parents, while twins are proverbially alike in some one if not all these particulars.

"We conclude, therefore, that there are few, if any, physical, moral, or mental acts of a woman's life that are not without some influence, however inap-

preciable, on every child which she may subsequently bear. And every succeeding child is influenced by the impressions left on the maternal organism by each and every preceding child, though they may all have been of the same father, and this influence is increased with the number of fathers. This brings us to the subject of resemblance of a child by a second husband to the first, which is not within the limits of the subject under discussion.

"After or at the time of impregnation, the father begins to exert a combined influence with the mother, though this influence is much less considerable than that of the female, for in addition to the influence exerted before impregnation, she has begun a new process, which only ceases at the completion of the term of gestation. During lactation the child is impressed in some degree, however slight, by the varying conditions of the mother. Through this source it may imbibe cachexias, diseases, tastes, and inclinations. Indeed some writers have made this an argument against the use of the milk of the lower animals, lest the child should be brutalized by such food. Tupper contends that children are even educated in their mother's milk.

"Every child a woman bears inoculates, so to speak, her constitution with some of the peculiarities of the father of the product; and, other things being equal, it is probable that the greater the number of children the greater will be the impression made upon her system by the husband, until she will finally come to resemble him in some degree at least. This influence is probably greater in the cases of gestations with daughters than with sons, for three reasons, viz.: 1. The father's influence begins earlier in the case of female conceptions, as the ovum is fecundated at an earlier period of development. 2. Female fetuses sap the vitality of the mother more than males. 3. Daughters resemble the father more than sons. From these reasons, then, it is only fair to infer that a woman who had borne a certain number of daughters ought to resemble their father more than after bearing the same number of sons. The husband will therefore lose a part of his individuality, or rather his wife will have acquired a share of it. If this be true, the younger children ought to resemble the father more than the elder; and, if the mother's system can be inoculated with his defects and diseases, even though they be constitutional, as is certainly the case in syphilis, it is only fair to infer that the younger children would be more likely to inherit a predisposition to these affections than the elder and consequently have relatively a lower viability."

During the convention of the Southern Dental Association, 1874, the question of *Irregularities of the Permanent Teeth,* their causes and treatment was considered by a great many dental practitioners and the discussion will undoubtedly prove interesting in illustrating the general thought of the time.

J. S. Knapp, Pennsylvania Journal of Dental Science, Vol. 1, 1854, page 449: In opening the discussion, said that the causes of irregularity have, to some extent, been touched upon in the discussion of the deciduous teeth. He thought that a premature extraction of the deciduous teeth led to a contraction of the jaw, and thus often produced very troublesome irregularities.

"In correcting irregularities great care should be taken, and the pressure should be as direct and regular as possible. This will bring the teeth which are

out of line gradually into place. When the incisors project so much over the teeth as to cause a deformity, it is much more difficult to draw them into a normal position, than it is to spread the arch if too much contracted. It is not only the difficulty of getting them in place that makes the operation so objectionable, but they must be held long enough to allow a deposit of bone to be made in order to make the operation successful. If plates are used, great care should be taken that they fit accurately to the teeth, or the gum will become inflamed; if this should occur, nitrate of silver or iodine should be used as a remedy. If ligatures or rubber rings are used, they should be kept from slipping up on to necks of the teeth, thereby preventing inflammation, or a premature absorption or recession of the gum. By observing these principles some of the dangers attending this tedious operation will be avoided, and the results will be most satisfactory."

Dr. J. R. Walker in the same journal said "he used rubber rings first to get them into line with each other, and then constructed a scaffolding on the boy's face in order to get a proper purchase to bring them into a natural position. This consists in placing a wooden appliance, carefully fitted to the teeth, across them in front, the ends extending beyond the mouth on either side, and attached by elastic bands to a pad on the back of the neck. In this way he succeeded in righting this most disagreeable wrong in three months' time. He uses ligatures and rubber rings in regulating teeth, and when a plate is needed he uses aluminum in preference to any other material."

"*Dr. W. H. Morgan* uses the jackscrew, and approves of it as an appliance for regulating teeth. He described a case in which he used jackscrews imbedded in a rubber plate, the heads so arranged as to bear against the teeth to be moved, and then by a turn or two every day spread the arch successfully.

"*Dr. S. Welchens* desired to speak more particularly upon the subject of what is termed heroic treatment of irregularities. Believes in moving teeth as rapidly as possible, and in such treatment is not at all solicitous as to the age of the party operated upon. Care should be taken, of course, not to produce undue inflammation in patients a little advanced in life. Heroic treatment is safer and less liable to bad results in the case of young and healthy persons, when the vigor of youth will effect a speedy and successful recuperation. In every case care should go in hand with intelligence and good judgment."

S. H. Guildford in the *Pennsylvania Journal of Dental Science,* 1874, in an essay on *Irregularities of the Teeth and Their Treatment,* said "The causes tending to produce, and the means applied to prevent and correct irregularities of the teeth, have received some attention from us as a profession, but they have not, I believe, received nearly the same attention which their importance demands.

"While we trace the filling of teeth and the wearing of artificial substitutes back a couple of centuries, we have nothing to lead us to believe that great irregularity was known very long ago, and hence no cause excited for its correction.

"The primitive mode of life had much to do with this; but modern civilization, or civilization as it has existed within the past fifty years, and more par-

ticularly within the last twenty, has made sad havoc, not only with the tissues of the teeth, but with the time and manner of their eruption and their respective positions in the dental arches.

"Our present manner of living, which induces, indeed almost compels, us to avoid eating those portions of food which were designed by an all-wise and beneficent Creator for building up and sustaining the framework of our bodies, and further keeps us from giving the dental organs the proper amount of activity and work to insure their strength and healthfulness, is the primary cause of irregularity among them.

"Were there a sufficient proportion of lime salts in the alveolus and tooth substance, placed there in the economy of nature by the eating of proper food, this same food giving health and tonicity to the blood, strength to the nervous system and density to the muscles and soft tissues, and did we at the same time give our teeth enough hard work to do, it is safe to say that in the second succeeding generation irregularity would be unknown and decay almost so.

"We as a profession, like the medical faculty, are gradually working up to that higher standard, which has for its object the prevention, rather than the cure, of disease. Let us press faithfully on toward this mark, and while we go let us endeavor by our best efforts of mind and body to relieve and remedy defects as they now exist.

"Among the things that are most usually regarded as the causes of irregularity, and so laid down in the textbooks, are the too early extraction, or long retention of the temporary teeth; disease of these teeth, resulting in abscess and disintegration of the alveolus, and blows or accidents, either to the temporary teeth or to the permanent ones in the course of their eruption.

"Among those cases to be begun before all the temporary teeth have been shed, may be mentioned: the protrusion of the lower jaw, to be corrected as soon as possible by bandages; and the throwing out or in of a permanent tooth that has by some means been moved out of position and shuts respectively outside or inside the opposing arch.

"Among those, however, most usually met with, are protrusion of the lower jaw, thus allowing the lower teeth to bite outside the upper ones; a narrow and contracted superior arch, very much resembling a "V" with the angle of the letter resting between the central incisors; the superior incisors falling inside the lower arch, and the cuspids in consequence protruding from the alveolus outside of their proper arch, probably resting upon the laterals and first bicuspids, giving an undue prominence to that portion of the upper lip just over them, and producing a general disfigurement in the person's appearance.

"Unless all these conditions are met in the beginning, it will be useless for the operator to waste his time and the patient his money in making any attempt at improvement. The means employed from time to time for the correction of irregularities have been varied and numerous, the prime factors in such cases, as in physics generally, being the inclined plane, the wedge and the screw.

"The inclined plane for moving the upper incisors from within outward, was probably used at a very early period, and continues today to be one of the best means employed for that purpose. The wedge, or the principle of it, was

used in spreading the teeth apart, thus widening the arch, or in producing space generally between two points. The screw was used for the same purpose, where greater power was needed, or where it could be more advantageously brought into play.

"The three motions to be produced in treating all such cases are expansion, contraction and rotation, or, if you please, tension, traction and torsion. Produce any or all of these motions as the case may require, and you have all that you will require to correct the worst case of irregularity that may present itself.

"What then, let us inquire, are the best means of producing these various motions, so that we may apply them to particular cases?

"Tension, or expansion, of the dental arch, or of several teeth on either side, was formerly, before the general use of rubber, produced either by a metal plate extending across the mouth, with slots filled with fusible metal opposite the teeth to be moved or instead of the fusible metal having pieces of wood which, when moist, would swell and expand, or it was produced by clasping the teeth to be operated upon and pressing them apart by means of a jackscrew extending across the arch of the mouth.

"Since, however, soft and hard rubber have come into general use, they have very much superseded metal for this purpose.

"To produce this expansion of the arch easily, rapidly and with comfort to the patient, it is only necessary to prepare a hard rubber plate closely fitting and covering the hard palate and lingual surfaces of the teeth to be moved, and inserting wooden pegs in holes drilled for the purpose in the plate just opposite the teeth. These pegs placed in the mouth dry and tightly fitting, will when wet expand and press the teeth; not only that, but you gain the benefit of the elasticity of the rubber plate. The advantages of such an appliance are, that it is very little in the way of the tongue; has nothing hard in its composition to injure the teeth; is easily removed by the patient for cleaning; does not show from the outside, and is thoroughly effective. I have been extremely successful in the use of these plates for the past eight years.

"Torsion, or rotation, frequently necessary, is perhaps one of the most difficult duties in correcting irregularity. The superior incisors very frequently require it, sometimes the canines and bicuspids, and not infrequently the lower incisors call for its performance. This may be done in several ways.

"One way is to tie a loop with silk or strong gilling twine around the tooth, over the opposite angle, attaching a rubber ring to it and fastening it at some point far enough away to produce very strong traction. This has a tendency to rotate the tooth.

"Another way, which was first used by Dr. Magill, of Erie, Pa., consists in fitting to the tooth a metallic band or ring and to the outside of this soldering a bar of platina-gold in such a way that when in position this bar will be at an angle of about forty-five degrees to the teeth on the side to which it is to be attached.

"When made, the band is fitted to the twisted tooth with ox. chl. zinc and the bar sprung down and tied to the second or third tooth from it.

"Here the elasticity of the gold bar will usually very quickly produce the desired result.

"It is an old saying that 'an ounce of prevention is worth a pound of cure,' and on this principle, I feel convinced, from many years' experience and observation, that if we can in any way prevent or arrest the course of irregularity in teeth, it should be done. That this may be done in very many cases by the judicious extraction of the first permanent molars, I most firmly believe."

George T. Barker before the same society discussing Guilford's paper stated:

"He was glad to find his views, as expressed two years ago, at Gettysburg, on the extraction of the six-year molar, so well sustained here. He held that the structure of the human body is becoming rudimentary, and that as a rule the jaws are becoming more contracted, so that there is not room enough for thirty-two well developed teeth. We should preserve the symmetry of the features and try to develop a good regular denture. This could be done only by extracting the six-year molar when the patient is yet young. In correcting irregularities he always secured the cooperation of the parents as well as the child, and is careful to let them know the probable cost of the operation, as well as the inconvenience and pain it may produce. He uses rubber rings and ligatures mainly, in his treatment of irregularities, and thus obviates the use of plates. In extracting for such correction he prefers the removal of the six-year molar."

Before the Association of the Pennsylvania College of Dental Surgery, *Dental Cosmos,* page 239, 1874, in a lengthy oral address upon *The Old and New Methods of Correcting Irregularities,* Barker stated "that the old methods were intricate, the appliances worn with great discomfort, and that attempts to regulate were something that every operator avoided if possible, because attended with a great amount of labor, the compensation being slight. He deprecated the use of plates and the inclined plane, claiming that by such practice the proper articulation was likely to be destroyed. In all cases before commencing the operation, it is necessary to have the patients not only willing, but anxious that it be done, for then they do not object to the discomfort necessarily attendant. Whenever a tooth is moved there must be absorption and corresponding deposition of new tissue, and this is best brought about by having the will of the patient enlisted, such state being conducive to nutrition. He regulates by elastic ligatures entirely, and expects success in three or four weeks. Most operators have difficulty in preventing ligatures from slipping up at the neck of the tooth and causing irritation. This difficulty he obviates by passing a gilling-twine ligature posteriorly above the basilar portion of the tooth, bringing it anteriorly to about the middle of the labial surface; here it is tied in a surgeon's knot (by passing the end of the string through twice); it is then carried posteriorly to a point midway between the basilar ridge and cutting edge, the ligature being brought over the anterior face, when it is tied with the knot first made. This is, to all intents and purposes, two ligatures joined at about the center of the labial surface, and, as each holds the other in position, there is no possibility of either of them slipping. If it is desired to rotate a tooth, the knot may be placed on one side or the other as may be necessary to apply the force in the proper direc-

tion to produce the desired result. The elastic band is attached to this double knot and passed anteriorly to those teeth that are outside, and posteriorly to those that are inside the arch. He attaches the band to two or three other teeth, that their resistance may be greater than the force required to move those teeth which it is desired to regulate. A number of models of cases that were successfully treated by him in this way were shown, and the *modus operandi* explained at length."

A. C. Hawes, before the First District Dental Society, New York, 1874, (*Dental Cosmos,* page 426) described a simple appliance he had devised for bringing central incisors into line when rotation is required. "From the diagram the principle will be easily understood. (Fig. 13). (*a*) The centrals to be rotated. (*b*) The bolt passing between the teeth, its head resting against the labial surfaces, and the shaft made to screw into the short bar. (*c*). With this simple appliance he had succeeded admirably, without encumbering the mouth with a large and troublesome apparatus."

J. R. Walker in the same journal, page 490, "spoke of a case where the teeth in the lower jaw had fallen back by reason of the loss of the six-year molars, so that the upper projected half an inch, while the teeth were so short that it was impossible to get a hold on them. He had used an appliance consisting of a

Fig. 13.—Hawes' method of rotating incisors.

stick across the front teeth, the ends of which were attached to elastics which went behind the neck, and succeeded in drawing the teeth back in three months."

Alexander Ogston in the *Glasgow Medical Journal,* 1874, considered a subject which at that time attracted but little attention but today may be considered of the greatest importance: *"On Congenital Malformations of the Lower Jaw."*

"The difficulties inherent in the subject are twofold. In the first place, cases of these malformations are very rare, forming a marked contrast in this respect to those of the upper jaw, so fully studied and so usual in the experience of every surgeon; and, in the second place, the cases which have been put on record by no means harmonize, at first sight, among themselves, and have even been deemed capable of very different explanations.

"The immunity of the lower jaw from deformity, already alluded to, seems to be as marked a feature in its later as in its earlier stages of development. It is found that irregular position of the teeth (a mere mechanical accident), and the formation of tumors, are equally common in both jaws; but what may be called vital processes, such as the malformations of congenital syphilis, and the deformities specially connected with mental development, are most marked and most frequent in the upper jaw.

"The congenital malformations, which are alone treated of here, exist in various forms and degrees."

Ogston divided the subject as follows:

"Nondevelopment of the inferior maxilla.

"Excessive development of the lower jaw.

"Congenital smallness of the lower jaw.

"A. Congenital smallness of both halves.

"B. Congenital unilateral smallness of the lower jaw.

"Congenital dislocation of the lower jaw.

"The cases adduced above, which are all, or almost all, that have been recorded, are too few in number to enable any very valid deductions to be drawn. So far as may be judged from them, however, congenital smallness of the lower jaw does exist, though rarely, and is usually conjoined with symmetrical deformities elsewhere, such as cleft palate, etc. In some cases the jaw so affected carries a diminished number of teeth, in others this is not the case, and at all events the absence of some of the teeth is more probably a consequence of the cause which has produced the smallness of the jaw, than itself capable of explaining the origin of the smallness. It seems further justifiable to conclude that, where the subjects of this deformity survive to adult life, they are not unlikely to become affected by such superadded deformity.

"Having now given as complete a résumé as lies in my power of the various congenital malformations to which the lower jaw is subject, and interpolated, where it seemed necessary, explanations sufficient, I hope, to have rendered clear the views of these which we seem justified in adopting, it only remains for me to embody in a series of propositions the conclusions we seem warranted in drawing from our present knowledge of these deformities. These are as follows:

"1. Congenital deformities of the lower jaw are very rare.

"2. Nondevelopment of the lower jaw has been recorded in animals, but never in man.

"3. Excessive development of the lower jaw appears to occur, though very rarely, and minutely recorded cases of it do not exist.

"4. Preponderance of size of the lower jaw has been observed as the result of deficient development of some of the other facial bones.

"5. Congenital smallness of the whole lower jaw occurs, and is generally associated with symmetrical deformities elsewhere.

"6. Congenital smallness of the whole lower jaw may lead in after life to acquired deformities of the bones of the cranium and face.

"7. Congenital smallness of the lower jaw has been found in one case with, and in two without, formation of the temporo-maxillary articulation of the same side, and coincided in all asymmetry of the cranium.

"8. Congenital dislocation of the lower jaw is said to have been met with in a single imperfectly recorded case."

S. James A. Salter in his book *Dental Pathology and Surgery,* 1875, devotes considerable space to *"Irregularities in the Position of the Teeth, Causes, etc.,"* and from it we gain a great deal of knowledge as to the treatment and theory

of this branch of dental science, during this interesting period of orthodontic growth. This work gives us the best analysis of this subject, in America, during the seventies, and demands careful examination and study.

"Irregularities of the teeth, as regards their relation to each other and to the laws containing them, constitute some of the most important considerations in the practical treatment of the teeth, and they are not without interest theoretically.

"Irregularities of the temporary teeth are uncommon, and are not of much importance. The incisors sometimes have a distorted position, but the commonest form of irregularity in the teeth of the first set is that which is relative in the two jaws. It is not very rare in families where there is a strong tendency to what is known as an 'underhung bite,' for the temporary incisors, or even the canines of the lower jaw, to project beyond those of the upper. And though this may not be attended by any irregularity of the relative position of the teeth in either jaw, it still constitutes a serious irregularity of the teeth as taken collectively.

"These irregularities of the temporary teeth may not require immediate interference, but they indicate the propriety of most careful superintendence during the advent and progress of succession.

"Irregularity of the teeth appears to be one of those conditions induced by artificial life, and progressing in degree during the lapse of time in successive generations. It is almost unknown among the lower animals in a wild state; but it has been induced in some through domestication.

"This subject may be treated with almost endless extension, and with profuse illustration, as the conditions of irregularity are almost without limit in their variety, and may be complicated in cause.

"I propose to consider them here briefly and practically, and principally by illustrative cases that have occurred in my own practice.

"The causes of irregularities may be (1) congenital and hereditary, (2) the prolonged retention of temporary, (3) accidental mechanical influences, (4) disproportion of the size of the teeth and jaws, (5) faulty development of the jawbones.

"There are few conditions in which hereditary influences are more manifest than in the irregularities which occur in the teeth; and these show themselves often in minute particulars, and are displaced with distinctness by collateral relations. The prolonged retention of temporary teeth is frequently associated with irregularity in their successors or their permanent neighbors, and is probably often the cause of such irregularity; though perhaps the imperfect or tardy growth of the permanents may be at least partially the reason why temporary teeth are so retained. Accidental mechanical influences, such as thumb-sucking or hypertrophy of the tongue, will cause certain irregularities. But by far the most common cause of irregularities in the teeth is their being disproportionately large in comparison with the jaws. This is a condition which has been progressing in development for a long period of time and very many generations, and appears in some way dependent on civilized life. The disparity is such as to lead to the crowding of the teeth so constantly seen, and

which is sometimes so excessive as to altogether exclude some member of the dental series from eruption, and hold it permanently impacted in the substance of the jaw.

"This condition is not infrequently induced by the premature extraction of the temporary teeth, which permits contiguous permanent neighbors to approximate each other to the displacement or partial exclusion of the successor of the extracted tooth.

"Malformation of the jaws is much less common, and is only certainly displayed in some peculiar irregularities, as in the V-shaped jaw.

"In considering irregularities of the teeth in regard to their treatment, they may be divided with much practical advantage into (1) simple (2) compound or contingent.

"Simple irregularities are those in which the misplacement is absolute as regards the jaw affected, and independent of the position of the teeth in the opposite jaw. They may affect both jaws in the same individual, but they are uninfluenced by each other.

"Compound irregularities are contingent on the position of the teeth of the opposite jaw, as to cause or maintenance, and are dependent on the 'bite.'

"The importance of these distinctions will be manifest in considering the treatment of these cases. In curing irregularities it will be necessary to remove all obstructions which prevent the teeth from assuming a regular arrangement; and it may be necessary to apply mechanical elastic force to complete that result. Both these elements of treatment may be requisite in a single case. Again, there is a peculiar method of applying mechanism where no force is involved, namely, in those cases in which the irregularity is contingent on the bite, and where the closure of the mouth causes its maintenance. In such cases the jaws must be kept apart during treatment, and this is accomplished by the passive mechanism of gagging.

"Very much depends on the age of the patient when the irregularity comes under treatment. For instance, where it is brought about by crowding, the mere removal of some tooth or teeth in a young patient may allow the remainder to assume the natural arch, and this they will generally do without assistance; whereas the same condition in an older patient will require mechanical pressure to place the teeth in proper range, and it may be necessary to maintain them in this position by similar means for a considerable period, as when once firmly established they have a tendency to return to their original relations."

The question of extracting teeth to correct irregularities seems to have been a very potent problem even at this period and Salter's views will give us some idea as to the controversy existing even then.

"It has appeared to me that this subject may be conveniently treated by the consideration of typical examples of irregularity where the upper canine tooth, from insufficient room, makes its appearance high up, and in front of the range of contiguous teeth. I refer to this form of irregularity, first, not only from its frequency, but because its consideration involves many general questions of importance bearing on the whole subject. It may arise from the premature

removal of the temporary canine tooth, thus allowing the bicuspid and lateral incisor to approach close to each other.

"This condition usually manifests itself between ten and thirteen years of age, and, if uncomplicated, it is readily cured by the extraction of a tooth behind the coming canine; and in the simplest cases the removal of the first bicuspid, effects the remedy at once. Circumstances, however, may suggest the desirability of sacrificing another tooth, the second bicuspid, or even the first molar; and this point requires careful consideration. And it should further be remembered that much may be done by nature, through the expansion of the jaw itself; and this is especially the case where the permanent teeth make their appearance very early, and at a time when the jaw, from the age of the patient, may be supposed to be too soon invaded by its large and many occupants. I have sometimes known bicuspid teeth removed to make room in young patients with much crowding, when afterwards it has been apparent that such a proceeding was unnecessary,—the jaw growing to such an extent that considerable spaces were developed between the remaining teeth—spaces which in the aggregate would have accommodated the teeth that had been extracted. It is a question, therefore, with young patients to consider how much may be done by nature in time, before a sacrifice is entailed which can not afterwards be remedied.

"In estimating which of the three teeth (first or second bicuspid, or first molar) should be extracted in any given case, many points arise which should be carefully balanced in the mind of the operator before he makes his selection. The respective value of the teeth must be considered as features, as organs of mastication, and in relation to their prospective durability and their soundness at the time. These are all important points for consideration, irrespective of the cardinal question as to which tooth would, by its removal, best effect the required object, furnish the needed room, and allow the misplaced anterior tooth or teeth, to range in proper order with the others. Unquestionably the bicuspid teeth are superior as features to the molars; indeed, the farther forward in the mouth a tooth is situated, the more does it modify the form of the lips, the more is it seen in expression, and consequently the more would its absence be remarked. It must be recollected, however, that there are two bicuspids, so much alike that when one is lost the other takes its place as far as appearance goes. As an organ of mastication a molar is of greater value than a bicuspid. The present soundness or otherwise of the bicuspids and molar is a question of the greatest importance, and must often decide finally and peremptorily the question under consideration. Provided the loss of either a bicuspid or a first molar would give the necessary space with equal ease and certainty, or nearly so—one being carious and the other sound—there can be no hesitation as to which should be extracted. The decayed tooth should be taken out, and a double good will thus be effected, the regulation will be achieved, and a source of future or perhaps present pain will be removed. It must be recollected, however, that it will take a far longer time for the crowding of the canines and incisors to obtain relief by the removal of a molar tooth than by the loss of a bicuspid; and in patients who have reached some fourteen or fifteen years of

age, or in whom the irregularity has existed for some time, it may be doubtful if the loss of a molar will extend forward the required relief. And this leads to the consideration of another very important point. The 'te' of the bicuspids in the two jaws may be interlocking; the cusps of the lower bicuspids may so abut, when the mouth is closed, upon the posterior aspect of the cusps of the upper bicuspids as to prevent the latter from moving backwards after the removal of the first molar; and thus, though the room may be furnished, the crowded upper front teeth are mechanically prevented from obtaining the benefit of it. The operator, therefore, should well look to this point before deciding on the removal of a molar. I urge this, not on theoretical grounds, but because I have more than once seen a molar removed under these circumstances; and, the bite keeping the upper bicuspids immovably forwards, no improvement in the irregularity took place. Finally, the question of relative prospective durability, as between the bicuspids and first molar, supposing each to be sound, is a point the importance of which can not be overestimated. This matter is not so easily decided by the statistical records regarding the decay of the two teeth as has been imagined. No doubt first molars are more prone to decay than bicuspids, and it may be prognosticated as probable that at the time any particular first molar is cut its term of soundness will be shorter than that of any particular bicuspid, when it first comes into the mouth. But that does not state the case fairly. The question is, which tooth, supposing both to be sound at the time when regulation is required (say at about twelve years of age), has the best prospect of prolonged soundness and usefulness? It should be remembered that a first molar tooth at that time has been in the mouth some six years and if then sound, it has for that long period resisted the influences of decay. The bicuspid, though also sound, has only been exposed to like influences for a year, or a few months. The existing evidence therefore, though negative in its nature, is, as a matter of probability, altogether in favor of the molar on the score of prospective soundness; and my own experience is that if a first molar is free from decay at twelve years of age, it is nearly as likely to remain sound as any other molar; whereas no such estimate can be formed of the prospective durability of a bicuspid that has been in the mouth only a few months. This is the real question as between a sound bicuspid and first molar at the usual time for removing one of them to make room, and it is in favor of the retention of the molar.

"I would, therefore, say, as a summary of these arguments: Provided the removal of either tooth would be equally efficacious, or nearly so, remove a decayed tooth rather than a sound one; this will lead to the very frequent extraction of the first molar. If both the bicuspids and first molar are sound, extract one of the former; and the regulation, though not more effectually perhaps, will be more speedily accomplished than by removing the molar.

"The foregoing observations have been written with special reference to the upper teeth, but they may be applied to those of the lower jaw. The greater durability of the inferior bicuspids, however, and the more easy cutting and more forward position of the lower wisdom-tooth which result from the removal of a first molar, would tend to balance more evenly the claims of the two teeth respectively; still, where both are sound at twelve years, I would remove a bicuspid

and retain the molar. As regards the first and second bicuspids respectively, the removal of the former I consider preferable.

"This crowding of the canine tooth in the upper jaw upon the lateral incisor, entailing the loss of a tooth to remove unsightly irregularity, not infrequently involves another question of much nicety and requiring a judicious balance of opposing arguments. The question I refer to does not relate to the loss of a bicuspid or a molar, to make room for more forward teeth, but it is this: In a confirmed irregularity in a patient of more advanced years, when posterior room can not be expected to allow the canine and lateral incisor to range in proper arch, the disfigurement being great, which of the teeth in question ought to be sacrificed? Such cases constantly occur.

"An overlapping and crowding of the upper incisor teeth is not uncommon, and may exist in various degrees and forms. The accompanying illustrations are of a sufficiently characteristic example (Fig. 14), and show the treatment which rectified the irregularity in this instance. The left central incisor projected beyond the normal arch, while the right central and both laterals were within it. To obtain room the first left bicuspid was extracted, and then a plate

Fig. 14.—Salter's metal plate, applied to the teeth.

Fig. 15.—Salter's metal plate.

(Fig. 15) was adapted, in which processes *a* and *b* pressed out the in-standing teeth, while a band of hard elastic gold, *c*, drew in the projecting incisor.

"An incisor tooth being twisted and placed more or less across the line of the maxillary arch, is another not uncommon irregularity.

"In contingent irregularities, where the bite is intersecting, or altogether 'underhung' where some or all of the upper six front teeth shut behind the lower in closing the mouth, it will be necessary to adopt the passive mechanism of gagging, either alone or in combination with elastic pressure; for, if the jaws are not separated somewhat, the misplaced teeth are persistently held in their wrong position every time the mouth is closed.

"The gag consists of a little 'cap' (Fig. 16) made to a model of one of the molar teeth, and upon it are soldered thicknesses of metal enough to separate the front teeth; it is made to clip firmly the neck of the tooth, and it remains on permanently. In Fig. 16 the cap is seen embracing the second temporary molar tooth, which is the one I usually fasten it to. When the displaced upper teeth have advanced sufficiently to allow the lowers to shut behind them, the gag

should be removed, and then closure of the mouth completes the cure, by forcing forward the teeth which had been too backward.

"Crowding and overlapping of the inferior incisor teeth is a common form of irregularity. It very frequently occurs as a transient condition in changing the teeth; but, when it threatens to become permanent, treatment should be adopted, either by giving lateral relief, removing a bicuspid tooth, or by extracting one of the irregular incisors, and of these it is usually desirable to remove the most prominent. The gap readily fills up, and the loss of the tooth is scarcely to be observed.

"Separation of the teeth of the two jaws in the front of the mouth, while the molars are in contact, is occasionally met with.

"It may arise from (1) congenital malformation of the lower jaw. It may be induced (2) by contraction of the cicatrix of a burn in the throat, pulling down the front of the lower jaw; or (3) by the protrusion of an hypertrophied tongue.

"The treatment of these cases is tedious and often unsatisfactory. It may be sought to obtain two results—an increase in the width between the bicuspid teeth, and a diminished projection of the incisors and their sockets. The first object may be accomplished more or less by a palatal plate pressing the teeth outwards, the force being established and maintained by the width of the plate

Fig. 16.—"Gag" or crown applied to deciduous molars to open the bite (1875.)

being in excess of that of the interval between the teeth, and the pressure kept up by increasing the width as the teeth yield. This may be accomplished either by a metal plate, or by vulcanite or ivory, with the addition of compressed wooden pegs.

"A plate fastened to the first molar and second bicuspid may be the fixed attachment, from which the force is applied, and this may consist of metal bands extending round the front of the teeth, bent in from time to time as the teeth yield; or, what I prefer, an apparatus such as is here figured (Fig. 17). In this a frame, *c*, fits over the incisor teeth, and from this a spiral spring, *b*, extends to a swivel and screw, *a*. The elasticity of the spring soon brings in the teeth, and it should be tightened by shortening as the case progresses. Care should be taken that the bar across the palate does not obstruct the recession of the teeth and alveoli.

"Transposition of teeth is an occasional though rare form of irregularity.

"Inversion of the teeth is another and very rare form of irregularity."

Potpeschnigg, in the *Deutsche Viertel-Jahrsschrift für Zahnheilkunde,* January, 1875, describes *A Tooth Regulating Machine,* as follows:

"The difficulty often experienced in bringing an upper front tooth from within the normal arch even with its neighbors; the frequent complaints that

children will not wear a machine in the mouth, or with difficulty can be watched, and the circumstance, that for every individual case a new contrivance must be made, led me to the construction of the accompanying machine. (Fig. 18.)

"Description: (*a*) is a well padded leather cap, which embraces the back of the head, and in which is sown firm a little below the external occipital protuberance in the direction of the sagittal suture forwards—a steel splint (1″ wide, 1½″ thick), which ends horizontally in (*b*) half an inch away from the head, and, therefore, can not press the same. To the middle of the posterior border of the cap, at the beginning of the splint, is attached a small brass ring, through which the cord (*f*) runs, passing on either side under the armpits backwards, where the ends are securely tied, making it impossible to draw the cap over the face, (*e*) is a strong elastic bandage to be lengthened or shortened at will, and which prevents any lateral movement of the cap.

Fig. 17.—Another appliance of Salter's with spiral springs to retract lower teeth.

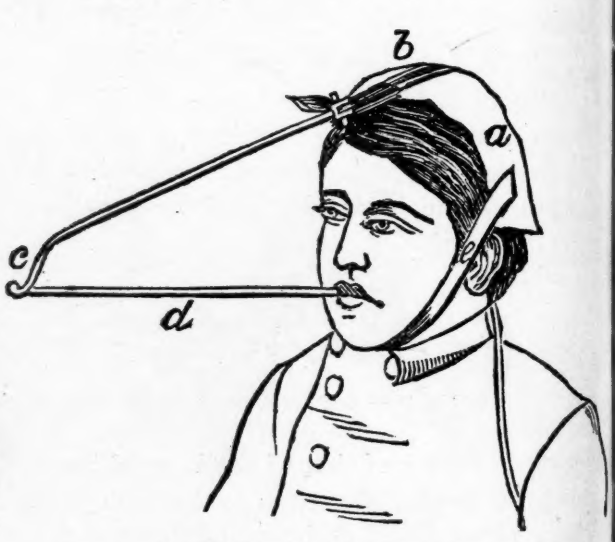

Fig. 18.—Method adopted by Potpeschnigg to correct irregularities of the teeth.

"A round steel rod, the thickness of a pencil, 18″ long is connected at (*b*) to the free end of the splint, through the united ends runs a perpendicular rivet, on which the steel rod turns from side to side. The end of the rod (*c*) is bent upwards. A firm point is now secured opposite the teeth from which a traction power can be exerted on the tooth within the arch, which is effected by means of an elastic ring. This traction acts on the steel rod like a weight suspended at (*c*); that is, it causes at (*b*) a fixture either to the right or left. If now the tooth be embraced close to the gum by the elastic ring, and this is slowly stretched over the end of the rod (*c*), it is possible to move the point (*c*) 90° either to the right or left, and it can readily be fixed at any degree desired. One is consequently in a position to draw the tooth, not only forwards but at the same time either to the right or left. The point (*c*) is so far off, that the patient can look at it without squinting. Unable to do more than point to a result, I now offer the following for consideration:

"1. The traction is constant and can be regulated.

"2. The moving of the tooth ensues without periostitis.

"3. The patient can not interfere with the action except by removing the elastic, which is easily controlled.

"4. The patient can eat, drink, talk, and play about without risk of injury from a fall, as the rod can give way in either direction.

"5. The contrivance is suitable for any case of the kind, as the cap can be reduced by tightening the bandage.

"6. The whole contrivance costs three dollars.

"The boy never complained of headache or pressure, and only once of an itching of the head after wearing the cap four hours."

Felix Weiss, in a series of articles presented in the *British Journal of Dental Science,* 1876, under *Notes From a Dentist's Case-Book,* explains the condition of Dentistry then in England, as we can see from some of the following extracts:

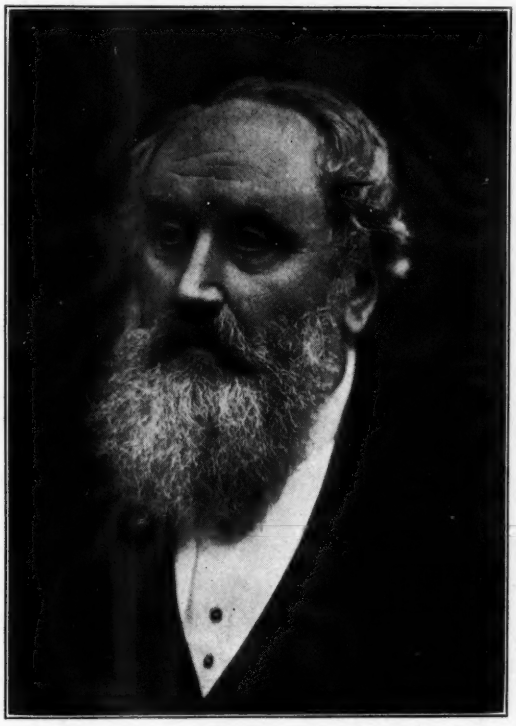

Fig. 19.—Felix Weiss.

"In glancing at the labors of more than a quarter of a century, with all its variety of incidents, experiences, successes, and failures, I feel half inclined, at first, to believe that there is but little that is but really new in our modern treatment of disease, and that our facts, in the main, have during the past fifty years, been but sparingly added to.

"Our daily practice appears at a first glance to be made up of the same cases with some slight modification, the same treatment with perhaps some trifling improvement; and while the whole world goes on repeating itself, we are irre-

sistibly drawn to the conclusion that, after all, we are but as miners turning up the rich soil of past experience, to lay down another layer that an after generation will perhaps exhume; picking out a fact here, and disputing an inference there, but with all making up the bulk of our daily toil by repeating over and over again the same words, giving the same advice, and following out very nearly the same treatment."

Under *"Hereditary Transmission of Peculiarities in Arrangement"* Weiss says: "These may be divided into two classes: 1st. Hereditary variations in the position of the teeth themselves. 2nd. Hereditary variations in the relative position of the superior and inferior maxillæ.

"Under the first of these heads we have a numerous group of cases where irregularities have been transmitted from parent to child, with but little modification, from one generation to another, but they are most of them of so usual a character and so frequently met with they hardly require particularizing here. The crowding of the upper or the lower jaw to the exclusion of one or more teeth, the canine being, perhaps, the tooth most usually thrown out of position. A class of cases in which the removal of a bicuspid or the first molar on each side, at the same time preventing the antagonism of the back teeth, is generally recommended.

"Again, we have peculiarities in the position of individual teeth distinctly traceable to hereditary causes. The overlapping of the central incisors, a distinctive mark, that in one family I am acquainted with, ran through all branches on the female side, and was called, so I am told, from the frequency with which it presented itself, T—y's mark. Two of the sisters I have seen, and a child just cutting her inferior incisors—a case watched with considerable interest.

"Hereditary variations in a relative position of the jaws themselves, although by no means uncommon, is not so frequently met with as the mere irregularity of one or more teeth.

"We now come to a class of irregularities presenting precisely the opposite appearance to those we have been describing. The upper teeth, instead of standing out far in front of the lowers, are inside the inferior circle, giving to the face that expression we are accustomed to see in persons said to be 'underhung.' This is an irregularity met with, if anything, more frequently than that of the opposite character, and although in the generality of cases it is more readily remedied, or at least the appearance improved, it is extraordinary how frequently its regulation is neglected."

"On the Retarded Eruption and the Absence of Permanent Teeth," Weiss wrote:

"Although the usual period for the eruption of permanent teeth may have long passed over, we have no reason to infer that the missing tooth or teeth have not been developed; indeed, in every case that has come under my observation, as far as the twenty-eight teeth of the second set are concerned I have never been able to do more than demonstrate that the eruption of one or more teeth has been retarded. Different individuals may vary as to the time of cutting, and although the molars are the most regular in their appearance, still they may deviate to the extent of fourteen or sixteen months or even longer. We

find in some families an hereditary predisposition to cut the teeth of the permanent set in a particular order, the bicuspids, for instance, coming soon after the eruption of the incisors. We also find an hereditary absence of particular teeth, the lateral incisors, for instance, not appearing until late in life and indeed sometimes not appearing at all until hastened by the wearing of a piece of mechanical work.

"That the temporary teeth may be extracted without occasioning any reduction in the ultimate size of the jaw I think we have plenty evidence to prove, but the early loss of these deciduous teeth to my mind is a fruitful source of irregularity in the coming set. Not only do we lose the directing agent which in many instances guides and controls the coming teeth, but we give the advancing organ increased labor, the bone has to be absorbed and the place which should have been reserved for it is already occupied. This is particularly observable when at an early date, owing to the crowding of the centrals, the temporary eyetooth is sacrificed, a practice I greatly object to. The permanent canine is compelled to take a position outside the circle or so far in the palate as to seriously affect the articulation."

F. H. Balkwill, also in the *British Journal of Dental Science* of 1876, in a series of articles to treat irregularities of the teeth described various *Regulation Plates.* He says:

"A plate was made to cover the palate, cap the molars and bicuspids, and come down outside them an eighth of an inch on the gum. It was not allowed to fill the gap between the left lateral and bicuspid, but at that part the palatal rubber was carried up rather higher than the tops of these teeth in order to carry a hole for a plug of compressed wood. The plate was filed a quarter of an inch back from the right lateral to allow this tooth to move in. (Fig. 20.)

"The elastic rings used were cut from the black India-rubber tubing sold with Maw's feeding bottles for the nursery.

"In order that a frame may act efficiently in a case of any difficulty it is important that it should be firmly tied in the mouth. (Fig. 21.)

"The second bicuspid being chosen as the most convenient tooth for the attachment of the ligatures, holes are drilled through the outside of the regulation plate about a quarter of an inch apart, so as to enter the impression of the second bicuspid nearly at the place to be occupied by the highest part of its outside cusp, that is, in the deepest part of the impression. (Fig. 21, *c c c.*) Fine mohair is passed around the neck of the tooth, and tied tightly on the outside at the margin of the gum in a knot. (Fig. 21, *a a.*) The fellow-tooth on the opposite side of the mouth having been treated in the same manner the loose ends of mohair which have been left about six inches long on purpose are threaded through the holes (Fig. 21, *c c c*) in the regulation plate, which is then slid up the ligatures into its place. The patient is now directed to bite hard; the ends opposite each tooth are drawn tightly, tied, and the superfluous ends cut away. (Fig. 21, *b b.*)

"Before the plate was put into position, however, holes were drilled at the posterior ends on the outside and an elastic ring, made by cutting a quarter of an inch off the black elastic tubing sold with Maw's feeding bottles, tied on at

each end. (Fig. 20, *a, b.*) A square-headed peg of compressed wood (Fig. 20 *c'*) was placed in the hole (Fig. 20, *c*), so that in expanding when in the mouth it should drive the left lateral and first bicuspid asunder, and virtually, the bicuspid being supported, drive the lateral towards the central. A ligature was then placed around the canine. This tooth was not fully through the gum, which was therefore slit to allow of the mohair being pushed under it until a firm hold of the tooth was obtained. I may here remark for the sake of young practitioners that this is more easily done than appears probable, as there is no adhesion between the gum or periosteum and the enamel of any tooth.

"The right lateral was a very long and prominent tooth; it seemed, therefore, desirable to pull it from as near the top of the crown as possible. This was done by beginning at the neck and crossing the ligature to and fro, tieing a knot at each angle of the zigzag, as seen in Fig. 20 *c*.

"The mouth and plate being now both ready to be brought together the end of one of the ligatures on the lateral (Fig. 20 *f*) was slipped through the elastic ring *b*, also one of those on the canine *g* through the ring *a*.

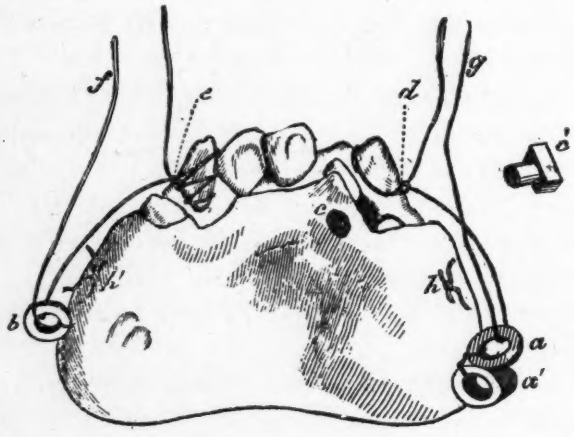

Fig. 20.—Balkwill's method.

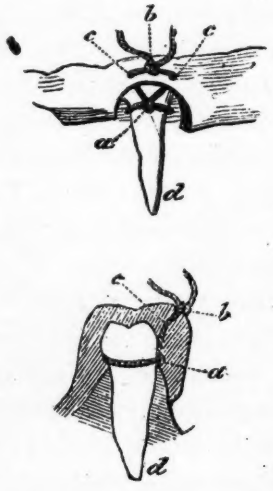

Fig. 21.—Method of attaching Fig. 20.

"The ligatures for tieing the plate on to the bicuspids were threaded in their respective holes as previously described, and the plate placed in the mouth and tied by them (Fig. 20 *h*).

"By drawing upon the ligature (Fig. 20 *f*) the elastic *b* was brought up to the knot *e*, and whilst held there by a blunt instrument tied. The same thing was now done to the canine on the other side by drawing upon the ligature *g* and tieing it at *d*. The distance between the knot *d* and the knot which tied the elastic *a* on to the plate was $1\frac{1}{16}$ inch, and the stretch of the elastic on the other side was the same.

"It being deemed advisable to try and bring the left lateral more out into the range of the teeth, it became a question for consideration whether it was better to draw it by an elastic or push it by compressed wood. The tooth being comparatively short, it was decided to draw it out by elastics, as compressed

wood acting on the inclined plane of the back of an incisor has a slight tendency to thrust it farther into its socket as well as outwards.

"The plate (Fig. 22) was therefore made, and fitted and tied in as the previous one. It carries a band of vulcanite, *a a*, in front of the incisor teeth without touching them; this was about half an inch deep and the tenth of an inch thick; it passed in front of the left incisor at a distance of a quarter of an inch. Through this band a hole was drilled at *b*, just opposite the tooth and rather above the line of the gum, so that the strain of ligatures passed through it to the lateral should be rather upwards as well as outwards. The outside edge of the hole at *b* was well countersunk, rounded, and polished, so as to give as little friction as possible to the ligatures; there *f f* and *e e* having been pre-

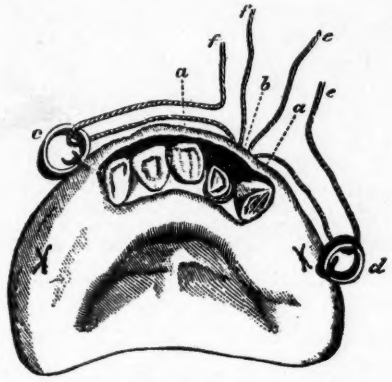

Fig. 22.—Another means by using a vulcanite plate.

Fig. 23.—An appl'ance with wooden pegs drilled in.

viously tied to the lateral were brought through the hole *b*, passed through the elastics at *c* and *d*, which were then stretched up to *b* and tied."

Another appliance consisted of a plate with holes drilled in "in such a direction that the peg shall press rather hardly into the gum, as it is advantageous to press the teeth from as low down as possible; partly because the power of the peg is in proportion to the amount of wood acting, and perhaps partly because it sets up a little beneficial irritation. This must not be overdone: it is only meant that the wood should rather press on the gum than be just touching (see Fig. 23). A little wedge of wood driven into a small end of the peg after it is in the plate will hold it firmly, and prevent your being annoyed by its coming out and being lost on the carpet when fitting to the mouth with file or penknife (see Fig. 23 *a, a*). The pegs may be changed twice a week whilst the space is very narrow, as the amount of wood being small we must make use of every

little gain until a peg of substance is admissable, when visits of once a week will be preferable.

"When sufficient space to admit the canines is gained, the same plate will suffice for drawing them into it.

"A stout elastic ring, got by cutting off a quarter of an inch from the black rubber tubing sold by druggists for enemas, is tied by the middle to the center of the palatal portion of the plate (see Fig. 23 *b*). Tie ligatures to the canines, and pass one end from each of these through the holes previously occupied by the pegs, through the loop of elastic nearest to it and back again through the same holes. The elastic is then stretched up to the holes by drawing on these

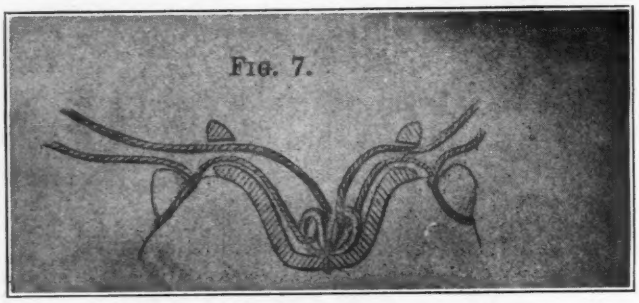

Fig. 24.—Method of bringing incisor teeth into line.

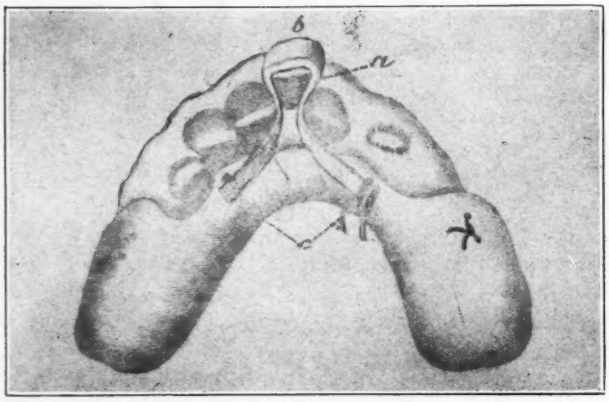

Fig. 25.—Another method of accomplishing the same purpose.

ends, and the two ends of the ligatures being tied keep it there, by its reaction to draw in the canines (see Fig. 24).

"When an incisor above or below is crowded outside the range of teeth, it can be brought in, and the adjacent teeth pressed aside to make way for it, very advantageously, by a straight piece of elastic interlacing them. A plate must be made which may cap the back teeth and come across the mouth behind the tooth to be operated upon, leaving room for its inward progress. Holes are drilled as near the proximal edge as is convenient, about half an inch on each side of the offender.

"Take an elastic ring, such as can be purchased at any stationer's, about a quarter of an inch in width, and as thick as a shilling. Cut a piece from this of such a length that when its ends are tied at the holes previously drilled it will lie

a little stretched between its attachment. The plate is now tied in the mouth to any convenient teeth, the elastic lying across the gap behind the prominent tooth. With a blunt instrument draw it through this gap, and slip the loop thus formed over its crown. Should there be any tendency to slip off it can be tied by a thread embracing crown and elastic diagonally.

"Fig. 25 shows a bird's-eye view of such an arrangement for the lower jaw: (*a*) central incisor; (*b*) strip of elastic rubber fastened to the frame at (*c.c.*)."

E. Balding, in the same journal, same year, page 531, *On the Treatment of Irregularities of Permanent Teeth,* wrote:

"In the course of my practice, treating cases of irregularities in the upper central and lateral teeth when they fall behind the lower ones, I have tried various plans.

"I have, instead of the compressed wood, used with better results large-headed swivel pins; but each of these methods seemed to me more or less defective. The success of the first depending too much on the voluntary efforts of the patient.

"In the second, the compressed wood required removing every day or every other day.

"In the third, the pins needed frequent readjusting as the teeth were moved forward to keep up the necessary pressure. All this in my judgment occupying too much valuable time, and entailing an unnecessary number of visits on the patient.

"In thinking over the subject it occurred to me if the principle of the inclined plane could be introduced into the upper instead of the lower plate, it would accomplish the object desired in less time and much more easily."

Winter Exodontia Club Number One

THE exodontists of Minneapolis and St. Paul had their first formal meeting at the Minneapolis Athletic Club, May 19, 1918. The guest of honor was Dr. George B. Winter, of St. Louis, the author of "Exodontia," and the originator of a new technic for the removal of impacted lower third molars. Dr. Winter demonstrated the efficiency of his system by removing a large number of impactions, at a clinic, the average time employed being less than one minute.

For recognition of his contributions to science, the Club honored him by naming this, the first organization of its kind, for him. The officers are: Harry B. Clark, President, and Carl J. Rice, Secretary.

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EDITORIALS

Education and Eugenics

AT the present time a great many articles are being written on the question of dental and medical education which have for their object the better education of the dental and medical man by increasing the preliminary requirements for college entrance and the lengthening of his professional course to a greater number of years. The purpose of this is to make him a better professional man and undoubtedly will accomplish it to a certain extent.

At the same time a great deal is being written on the question of a better education of the professional men another group of writers are producing articles on the question of improvement of the human race or upon the subject of eugenics. At first observation the subject of medical education and the question of eugenics may be close together or may be far apart. In fact, very

few individuals have given much consideration to the relation existing between higher education and eugenics. Those who may have been following the writings upon the question of bettering the human race have probably been surprised by the fact that college graduates, both male and female, do very little in regard to reproducing the human race as compared with individuals who are not so highly educated.

The number of children born to college men is very small compared to those born to individuals who are not college educated. The majority of women who are college graduates also make very "poor" mothers when judged by the number of children they rear. This would seem to indicate that higher education which should be an assistance to eugenics is really a detriment towards the reproduction of the human race. When we stop to consider the small size of the families as found among college men or the entire absence of children, we must admit that the individuals who seem to be the most suited to rear children from a standpoint of education, do not have them. Some writer a few years ago made the statement that the only individuals who knew how to rear children were the men and women who never married, which is almost true of college educated men and women.

We can equally say that it seems that the individuals best qualified to rear children are those educated along hygienic lines, but as a matter of statistics they have smaller families and produce fewer children than people who are not so well versed. Therefore, as a result of this the question of higher education and the question of eugenics for the improvement of the human race are working at variance with each other and as higher educational requirements are produced the number of children born to college graduates is going to continue to decrease instead of increase. In other words, from that class of people who seem to be the most suited to produce; so far as the improvement of the human race is concerned, we are going to have fewer and smaller families than we have had in times past. To state our subject more positive we may say that the increased medical and dental course is a factor which is contrary to the laws of eugenics and which is going to do more and more in the future to decrease the number of children born to medical and dental men. This is not only going to be true of medical and dental men, but is going to be equally true of men in other professions and training in which it requires a long period of education for the man to reach his goal. It would naturally seem that a medical man with his knowledge of medicine and hygiene would be the best qualified to rear a large family, but as a eugenical fact it is shown that they have smaller families.

This is not only true among medical and dental men but is true in other professions and lines of life which may be classed among the higher educated. In other words, the question of higher education and physiologic laws are at variance with each other and consequently the human family is going to suffer from the standpoint of eugenics just as educators continue to lengthen the time necessary for professional men to acquire an education and become self-supporting. Take for example the education of a dentist at the present time, in which it is necessary for the student to become a high school graduate before he can enter dental college. Then it is necessary for him to spend four years in dental school before he can graduate and then a certain number of years before he becomes self-supporting to the point where he feels he can rear a family.

By that time from a purely physiologic standpoint the individual has passed his most prolific years as regards the reproduction of the human race. It is a physiologic fact that the healthiest children are born from parents the father of which is between the age of 21 and 28. Those seem to be the years when the male of the human species is capable of reproducing the best offspring. Those years in the life of a medical or dental student are the years in which he is struggling to obtain his higher education or build up a practice so that he will be self-supporting. As a result of this every year that is added on to the education of a dental or medical student is simply added on at the expense of the physiologic life and reproduction, as studied from the standpoint of eugenics and related to the improvement of the human family.

We are willing to recognize the fact that the more highly educated the man or woman becomes the more they require in life, and the more they require of life's luxuries before they are willing to make the sacrifices to bring up a family. Along these lines we also note the more highly you educate an individual, the more you are going to force upon him a desire for those luxuries, and simply put the question of reproduction or improvement of the human race farther in the future until finally he gets so far along in the line of life that he is past his period of usefulness so far as eugenics is concerned. We therefore contend for the benefit of the human race there should be a physiologic side to the question of education, and the human family both men and women should not be so highly educated as to entirely obliterate the possibility of being useful in the production of the human race or in the improvement of the human race.

It is indeed a lamentable fact that the people who seem to be the most fitted to rear children as they should be reared are those who have the fewer children and the smaller families; and the only way this can be remedied is to recognize that there is a physiologic side to education and not make education such a specialty or so highly ideal as to eliminate the physiologic possibilities of educated men and women being useful from a eugenic standpoint. The only way in which this thing can be regulated is for educators to so arrange the education of professional men and women that they will be able to complete that education at a sufficiently early time in life so that they will still be able to fulfill the primary physiologic function for which they were placed upon this earth. When we consider the length of time that is necessary for dental students in times past to get an education and complete a three-year course and become self-supporting and be able to take care of a family, we recognize that the four-year course and higher education is simply going to place the thing farther in the distance.

The same is true of the medical student where the course has been lengthened year after year and now at the present time when a medical man obtains his education and spends the necessary time in a hospital and builds up a practice sufficiently large to take care of himself, he has become an undesirable subject from the standpoint of eugenics. As a result of this there is a question or relation between education and eugenics existing which should receive more attention from educators in the future than it has in times past.